# RIAL STUDIES

# UNITED STATES

ALLEN

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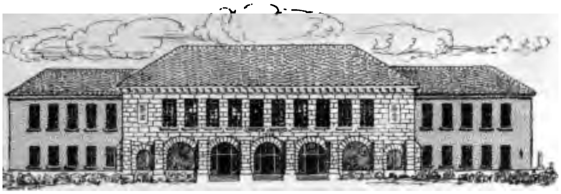

# INDUSTRIAL STUDIES

## UNITED STATES

BY

NELLIE B. ALLEN

STATE NORMAL SCHOOL, FITCHBURG, MASS

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# PREFACE

This is an industrial era. The nations which lead industrially are the controlling nations of the world. Nine tenths of the pupils in our schools will enter some form of industrial life. We are dependent for our food, clothing, and shelter on the great industries in our own and other countries. The whole world is united by a network of industrial and commercial chains.

A practical knowledge of the United States can be gained largely through a study of its industries. In this way the pupil is brought into direct touch with practical life and with that form of human effort which has, to a great extent, determined the rank and position of this country among nations.

In these Studies each industry is dealt with as a type, in order that the pupil meeting with the same subject in later work will understand its essential features.

The physical geography treated of in the early chapters is closely connected with the industries dealt with in later portions of the book. Such topics as soil, surface, climate, drainage, etc., will assume a definite, concrete form in the child's mind if studied not as detached subjects but as underlying causes of the success of certain great industries. If pupils learn to look for some of the causes of our industrial life in the physiography of the country, they will be better able, in studying other continents, to trace the connection between physical features and the industries which depend upon them.

Though the emphasis in these pages is laid upon industries as carried on in the United States, reference is made to their existence in other countries in order that the pupil may think of great world belts of production and not of areas limited by political boundaries.

Location of places should not be neglected. The lists given at the end of the chapters include all the places of importance mentioned in the text, and will be of help in reviewing location. If the pupils can locate each and give certain facts showing its industrial importance, they will have, in addition to their fund of information concerning the industrial life of the country, a definite, concrete knowledge of cities, states, rivers, mountains, etc. Many places are mentioned in more than one chapter. By keeping in mind the different industries connected with each, a broad knowledge of our great cities will be built up in the child's mind.

In the Topics for Study, given at the close of each chapter, much hand work is suggested. This is done with the firm conviction that motor activity is of the greatest aid to memory. Maps sketched, places located upon them, routes indicated, etc., will remain much more firmly fixed in the mind than if only orally described. In this connection the use of hectographed outlines, cut-up maps, railroad guides, and other material is strongly recommended.

The pictures and maps have been selected with much care and will be found of great help. Both should be studied as thoughtfully as the text itself.

The industries here presented have been studied with children for several years. The added interest and value that this work has given to the geography lessons is the reason for putting the material into more permanent form.

NELLIE B. ALLEN

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# LIST OF ILLUSTRATIONS

## SONG OF LABOR

I love the plowman's whistle,
  The reaper's cheerful song,
The drover's oft repeated shout
  Spurring his stock along;
The bustle of the market man
  As he hies him to the town;
The halloo from the tree top
  As the ripened fruit comes down.
The busy sound of threshers
  As they clean the ripened grain,
The huskers' joke and catch of glee
  'Neath the moonlight on the plain.
The kind voice of the drayman,
  The shepherd's gentle call, —
These sounds of pleasant industry
  I love — I love them all.

Oh, there 's a good in labor,
  If we labor but aright,
That gives vigor to the daytime,
  A sweeter sleep at night;
A good that bringeth pleasure
  Even to the toiling hours,
For duty cheers the spirit,
  As dew revives the flowers.
Then say not that our Father
  Gave labor as a doom, —
No! 't is the richest blessing
  From the cradle to the tomb.

# INDUSTRIAL STUDIES

## CHAPTER I

### INTRODUCTION

Our smoky cities, ablaze with light from blast furnaces or alive with the noise and whir of factories in which thousands of operatives spend their days, would seem strange and almost frightful to the people who lived a hundred years ago. The streets filled with swift cars, the hundreds of locomotives puffing and wheezing, and the crowded stores are as different as can be imagined from the quiet villages in which our ancestors lived, where they made their own clothes and shoes, and raised on the farm nearly all their food. If a trip to a near-by town was planned, they walked thither, or jogged along behind the sober farm horse, instead of flying along in steam or electric cars.

To-day factories, furnaces, foundries, street cars, and railway stations are familiar sights. Indeed, we should miss them if they were dropped out of our lives. It would seem hard to us to have to spin and weave our own dull-colored clothes, instead of going to the store and selecting from the product of a thousand looms the pretty colors which we like best.

We should find it inconvenient to wait for the village cobbler to come and measure our foot, and then make for

us, in his own little shop, a pair of clumsy shoes. How much better it is to step into a store and buy a pair of well-fitting shoes, the work of some great factory in which thousands of pairs are turned out each day.

It would be an interesting experiment, but not an easy one, to try for a time to live an entirely independent life, and to do for ourselves everything necessary. In order to have flour, milk, butter, and meat, we should have to live on a farm, where we could have land for raising grain, and pasture for cattle. We should need sheep, for their wool would be necessary to furnish material for our winter clothing. There must also be cotton or flax fields to supply the fiber for thin summer clothes. A vegetable garden and fruit orchard would be necessary if we were to have these wholesome foods.

Think, too, of the things which seem necessary in our everyday life that we have not mentioned, and of the work which would need to be done in order to obtain these necessities, if indeed we could get them at all. Lumber for the house, glass for windows, dishes to eat from, stoves to cook with, lamps by which to see and the oil to use in them, and many other things which seem so necessary to us must all be provided.

When we think of the things not absolutely necessary but which help to make our lives pleasant and comfortable, there are so many that I am sure you would not like to try the experiment of getting or making enough for your own use. Think of tea, coffee, chocolate, salt, oranges, bananas, olives, medicines, silk, ribbons, feathers, and watches or clocks. What a great variety of things there are which one cannot possibly make for one's self, or get

by one's own unaided efforts. To supply all these things our farm would have to be of enormous dimensions, large enough to stretch from the torrid zone to the cool temperate zone.

Even if it were possible to raise all necessary products on one farm, the hours would be so fully occupied in making them ready for use that little or no time would be left for books, music, and games. But stop a moment! If you are to depend entirely on yourself, you will have no interesting books unless you write them, no beautiful music unless you compose it, no amusing games unless you invent them. Is not the division of labor, in which each one does a few things well, better than if each one lived independently and tried to do everything for himself?

How is it possible that the many comforts of life are brought to our doors and are to be had at such small cost? The story is long if one were to tell it all, and as wonderful as a fairy tale. Indeed, the riches and gems that Aladdin found in that mysterious cave are no more wonderful nor precious than the riches we have found in the soil and rocks of our country.

The comforts which we enjoy to-day are made possible largely because of the fertility of soil and the wealth of our mineral resources. Wherever there is a fertile soil and a favorable climate, people are certain to settle, sure of finding a comfortable living.

In a new settlement, trade with other localities soon begins, for the pioneers must exchange the home products for necessities and comforts from distant places. In order to carry the merchandise, railroads and ships are built. As communication becomes easy and freight charges become

low, more people are attracted to the place, and the settlement grows. The opening up of our great West is a good illustration of the dependence of people upon the land and its products, and the help which railroads furnish in the development of a country.

Attracted to the far West first by the discovery of gold, people soon learned what a wonderful country stretches from the Mississippi River to the Pacific Ocean. They found that the soil might yield them even greater profits than the mineral wealth which men were flocking to obtain. The raising of cattle, grain, and fruit was started in a small way at first, but was gradually enlarged as the railroads grew in number and extent, and out-of-the-way places were brought into touch with civilization and commerce. New land was settled as the people were made sure of markets in which to sell their produce. The cities sent clothing, tools, machinery, furniture, and food to the small towns and farms and ranches. Cattle and wool, grains of various kinds, fruit, and cotton began to come to the cities in greater and greater quantities, until the question of how to transport these products, what was the easiest and quickest way to get them to the manufacturing centers, became all-important.

Irrigation, new and improved methods of farming, and discoveries of great mineral wealth have so increased our products that to-day the amount of production is limited not by the soil but, strange to say, by the railroads and other means of transportation. Immense quantities of live stock, beef, wool, grain, fruits, copper, gold, and silver are sent from the West to the East. Thousands of carloads of manufactured goods, such as clothing, boots and shoes,

tools and machinery, must be sent in return by the East to the newer West.

China and Japan are awakening to the fact that we are their near neighbors, and trade with both countries is growing rapidly. Formerly goods for Asiatic countries were sent on the long voyage around South America, or by train to our Pacific ports, to be there reloaded for the ocean voyage. A third route lay by water to the Isthmus of Panama, by train across the isthmus, and then by vessel across the Pacific Ocean. It is always more expensive to send goods by land than by water, and the time and labor spent in unloading and reloading freight add to the cost. If goods can be sent across the Pacific without unloading, you can see what an advantage it would be; and this will be possible from the Atlantic as well as from the Pacific ports, when the Panama Canal is completed.

You will learn in another chapter more about this and other canals, and also about the great railroads which cross our country, and which have made our trade and therefore our wealth and development possible.

Much of the wealth of the West lies in the products of which we have already spoken, the gold, silver, copper, cattle, sheep, grain, fruit, and lumber. Cotton and sugar, lumber and iron, have enabled the South to grow to her present state of development. The Great Plain finds its gold in the yellow corn and its silver in the snowy flour. Our mountain products are well balanced: coal and iron in the Appalachians, and gold and silver in the great Western highland. The following chapters describe these products, the physical conditions upon which they depend, and the industries connected with them.

## CHAPTER II

### POSITION AND SIZE

Most of the chapters in this book describe great industries which are carried on in the United States. The growth and development of the country, its rank among other nations, and its wealth and power are due largely to these industries. They in turn depend on certain causes. The position, surface, coast line, climate, drainage, and soil have been the factors which have determined to a great extent just what varieties of work the people shall engage in. Therefore before studying the industries themselves let us look at some of these underlying causes.

The position of the United States is very favorable. It lies in the path of the westerly winds, which bring to certain sections the moisture and even temperature of the Pacific Ocean. The wonderful effect of these winds on temperature, rainfall, and therefore on vegetation, will be told in the chapter on Climate. It lies not too far north, where little vegetation is possible; nor too far south, where the climate is so warm that people have little ambition to work, and where there is little necessity for it, as nature produces abundantly without man's aid.

The country stretches through more than twenty degrees of latitude, extending from the warm temperate belt in which cotton and sugar cane flourish, through cooler regions where corn and tobacco grow, to a cool temperate climate well suited to the production of wheat.

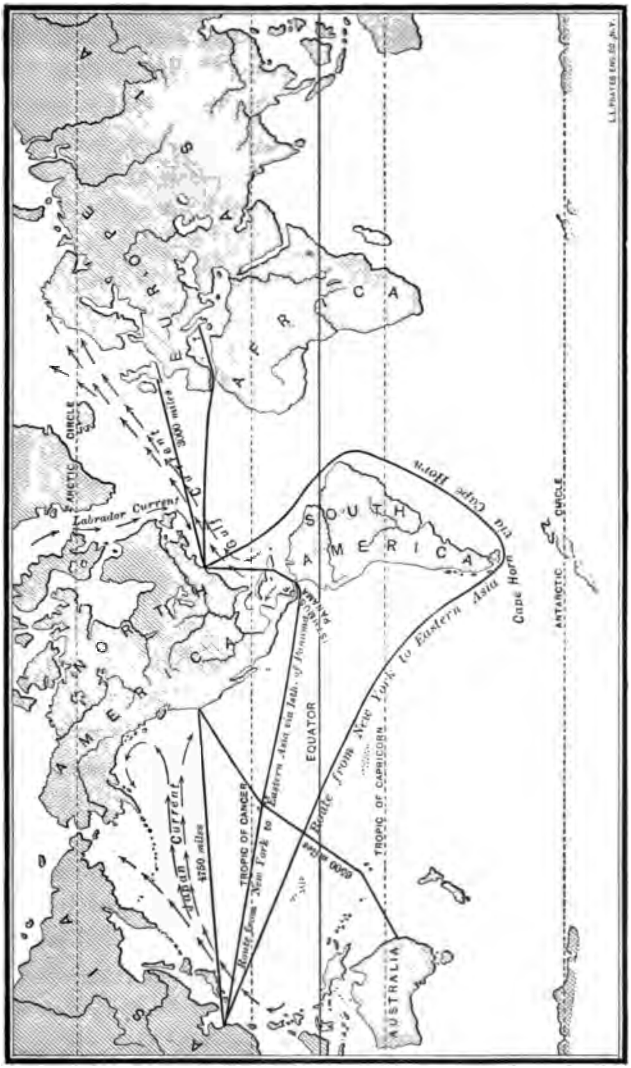


FIG. 1. TRADE ROUTES AND OCEAN CURRENTS

Let us think of our position with reference to other nations. To the north of us is Canada and to the south Mexico, friendly countries both, and because of their position able to furnish us with some products which are not found to any great extent in our own country.

Our eastern border is about three thousand miles from Europe, a great distance in the early colonial days when but few vessels, and those slow ones, crossed the ocean. The colonists were obliged to depend on themselves for many articles which, had they lived nearer Europe, would have been supplied by the mother country, and thus manufacturing soon became an important industry. As more and larger vessels have been built, the Atlantic seems to have grown smaller, for to-day we are less than a five days' journey from England. Hundreds of vessels cross this ocean, carrying our exports to European countries and bringing to us their products.

The great ocean mass in the midst of which North and South America lie stretches away to the west of us for five thousand miles. For many years after the Atlantic was crossed the Pacific was still unexplored. But to-day many steamships plow its waters, connecting us with Japan, China, and the neighboring islands; and great cables, over which messages may be sent, lie in its depths.

Thus the United States is so situated that we are connected by these ocean highways with Europe on the east and Asia on the west. Can you imagine our country a great eagle with one outspread wing touching Europe and the other stretching over the Pacific Ocean toward Asia? That is just what our wings of commerce are doing, connecting us with both eastern and western nations.

You have probably repeated, or have heard others repeat, that stirring oath of fidelity, "I pledge allegiance to my flag and to the republic for which it stands; one nation indivisible, with liberty and justice for all." Have you ever thought what an immense territory is the home of that republic? The United States is but little smaller than Europe, yet in that continent there are more than a dozen nations,

FIG. 2. HARVESTING WHEAT
Notice size of field

each with its own flag, its government, its laws. Each country is surrounded by others which may or may not contain friendly peoples. Each nation must therefore maintain a large army and be prepared at any time to defend itself. All this costs an immense amount of money which must be furnished by heavy taxation of the people. Thousands of men serve in the army whose labor is needed in fields and factories. What an advantage it is to us that we are separated by the ocean from all these nations, that we have few troublesome neighbors, and that we are all one big family with one ruler and one flag!

Our great wheat section embraces seven hundred and fifty thousand square miles, nearly one fourth of the area of the whole country, and our corn lands are even larger. We can ride for miles and miles over cattle and sheep ranches, or spend days in traveling through our cotton belt. You can easily see that the amount of our products depends somewhat on the great size of the country.

### Topics for Study

1. Find the latitude and longitude of the United States.

2. Name the advantages of its position.

3. Are there any disadvantages?

4. Compare its size with that of large countries on other continents.

5. What is its area? How does Europe compare in area?

6. Leaving out which country of Europe would make them about equal?

7. To how many of the following questions can you find the answers?

8. Name some of the important European steamship lines. Trace the routes they follow and find the destinations. What is the name of the largest steamer? How fast can she travel? How many passengers can she carry? How many men are in her crew? How much coal does she use on one trip? What forms a large amount of the freight carried from the United States to Europe? from Europe to the United States?

# CHAPTER III

## SURFACE AND DRAINAGE

You have read in the preceding chapter how the position and size of the United States aid in determining the kind and amount of its products. These depend also on other causes, among which are the surface and drainage conditions.

The United States consists of several great surface divisions. The low, level Coastal Plain extends along the Atlantic and Gulf coasts. Then comes the old Appalachian Highland, its peaks worn down through long ages by frost, rain, streams, and other agents into rounded, domelike elevations. The great Rocky Mountain Highland stretches through the West. This is a much younger system with higher peaks of sharp, jagged outline. Between these two highlands lies the Great Central Plain, through which flows the "Father of Waters," the Mississippi River, and its branches.

The Coastal Plain extends from New York the length of the Atlantic coast, and along the Gulf coast into Mexico. The part bordering on the Atlantic Ocean was for more than one hundred years the home of the early colonists, to whom the mountainous region to the west was an impassable barrier. Much of the soil of which it is composed is the wash from the highlands farther inland. This was deposited under the ocean waters, and by the accumulation of the soil itself, and by the slow, upward movement of the earth's crust, in time the land rose above the surface of the water.


Fig. 4. The Fall Line

Notice the trend of the rivers across the mountains

furnish water power for manufacturing. You will find on the map on page 14 some of the important cities which are situated upon the fall line. They owe their importance to their manufactures and to the fact that they serve as distributing centers for the surrounding region. Can you explain how both of these industries are due to the location?

The soil of the Piedmont Belt is for the most part fertile. In many towns situated near large cities the people are engaged in raising fruits and vegetables for the city supply. The important tobacco-growing area of Virginia and North Carolina lies chiefly in this section, and much of the upland cotton is grown in the Piedmont Belt. When you read the chapter on Fruit, notice what fruits are mentioned as being raised there.

Crossing the Piedmont Belt we come to the true Appalachian Mountains. These extend in several ridges and ranges from New England to Alabama. The Blue Ridge, which you will find given on the map, Fig. 3, is the principal chain. Mt. Mitchell in North Carolina is the highest peak of the Appalachians. Look at the pictures and you will see how rounded are the summits of these mountains, and how broad the valleys. Contrast this picture with the one which shows the sharp peaks of the Rockies.

The Green Mountains in Vermont, the White Mountains in New Hampshire, and the Adirondacks in New York are each a part of the Appalachian System, but are separated from the rest of the highland by the valleys of the Hudson and Mohawk rivers. This is the most important opening through the mountains, and from early colonial times it has served as a highway to the interior of the country.

The next division of the Appalachian Highland is the Great Valley. Although this name is given to the whole section, it is really a succession of valleys separated by low ridges of mountains. The Shenandoah Valley in Virginia and the Tennessee Valley in Tennessee are very fertile sections.

The most westerly division of the whole highland is the Allegheny Plateau. This is called a plateau because the strata lie horizontally instead of being wrinkled and crumpled as in true mountain formation. The rivers have worn down and intersected this plateau until to the eye of the ordinary observer it appears like a mountainous region. The Catskill Mountains in New York are a part of the plateau, though from their appearance they are commonly called mountains.

This great Appalachian Highland, consisting of mountains, valleys, and plateau region, was the barrier which confined the colonists to the narrow Coastal Plain. The height (though not great compared with that of the Rockies), the wild animals, the Indians, and the dense forest growth all served for a long time to keep even the most daring from venturing far. Stories told by the Indians of the rich lands to the west finally incited the hardy pioneers to brave the dangers. Rivers and smaller streams were then the only highways. Following these the settlers came, after weeks of hard travel, into the rich lands west of the mountains, in Kentucky, Ohio, and Tennessee.

If we search for these routes which the pioneers took, and which the railroads to-day follow, we must know something of the rivers of the region. If you look at a relief map you will see that most of the streams flow across the mountains at right angles to the direction of the highland.

Notice, for example, the Susquehanna, the Potomac, the James, and the Rappahannock. The rivers, which have thus cut their way through the Appalachians, are older than the highland and flowed in a southeasterly direction toward the Atlantic Ocean before the mountains were

FIG. 5. DELAWARE WATER GAP

formed. The growth of these mountains was so very gradual that the streams were able to cut down their channels as fast as the mountains were upheaved. As a consequence some of the rivers flow through narrow passes or gaps. The Delaware at Delaware Gap, and the Potomac at Harpers Ferry are perhaps the best known examples.

There are five great natural highways from the Atlantic Plain to the Mississippi Valley. Beginning at the north we find the St. Lawrence River and the Great Lakes. This was the route followed by the French in their explorations. Next comes the Hudson-Mohawk Valley, which was one of the chief highways both in the French and Indian War and in the Revolutionary War. Farther south we find a route which takes us up the Potomac River, through the historic Harpers Ferry and thence by the Ohio and its branches to the fertile West.

In Virginia a familiar route for the colonists lay through the gap of the James River into the long valley west of the Blue Ridge Mountains. Thence by following some stream they found their way over the Allegheny Plateau and to the West through Cumberland Gap, made famous by Daniel Boone, who traveled through this pass on his first journey to the unsettled regions of eastern Kentucky.

A fifth route lay south of the mountains through northern Georgia. Though comparatively easy, it was little used by the colonists on account of the Cherokee Indians who, under Spanish influence, barred the way.

Find these routes on the accompanying map. Trace and sketch them until you are perfectly familiar with their location. This is important, for these natural highways, caused by the drainage system of this section of the United States, were the chief roads of the Indians and later of the pioneers. And what is more important to us, they have become in more recent years the routes followed by the railroads which connect the coast with the interior. And the railroad which has found the lowest pass through the mountains, and the easiest grade over which to draw its freight,

has a great advantage over its rivals. Can you find out which one that is?

It is in these old, worn-down Appalachian Mountains that most of our coal and much of our iron are found. The fact that these valuable minerals are found there in such



FIG. 6. A FEW MILES FROM ORANGES TO SNOW

great quantities and so near together has determined the position of many manufacturing cities, of which more will be said in the following chapters.

The highland in the western part of the United States is a great contrast to the one in the East. In the Appalachian

Mountains we find beautiful wooded summits rounded and worn down through long ages, fertile valleys green with the crops of small farms thickly set, and rivers winding their way through broad valleys between sloping mountain sides.



FIG. 7. "OLD FAITHFUL" GEYSER

How different are the wonders of the Rockies! There can be found some of the highest elevations of the country, towering peaks ten to fifteen thousand feet high. There also are the lowest depressions, three hundred feet below the level of the sea; there are the greatest deserts and the

richest farm lands. In that western area can be found the hottest place in the United States, and while suffering from the intense heat one can see the glistening snows on the heights far above. In those snow-clad mountains are the sources of our longest rivers, yet there are hundreds of square miles traversed by no rivers at all. There are regions where one gazes in wonder at the largest trees in the world, and vast areas where no green tree or shrub relieves the gray surface of the desert. There, also, more than in any other area of equal extent in the world, can be found the most wonderful collection of glaciers, volcanoes, geysers, hot springs, salt lakes, and cañons.

Let us look at the arrangement of the mountains, valleys, and deserts which make up the western third of the United States. As one travels westward through the great Central Plain the land rises gradually during the thousand-mile journey which separates the Mississippi River from the highland. This gradual ascent terminates in a plateau more than a mile in height and a thousand miles wide. From its surface rise ranges of mountains extending north and south.

Along the eastern edge of the plateau, highest of all, are the Rocky Mountains, stretching from the cold lands of the far North to the tropical region of Central America. Though reduced to low hills in the Isthmus of Panama, the mountains rise again in even greater grandeur in the Andes Mountains of South America, and continue uninterruptedly to the southern extremity of that continent. In the United States they extend through Montana, Wyoming, Colorado, and New Mexico.

On the western edge of the plateau region rises the Sierra Nevada and Cascade Range. The Sierra Nevada, or "Snowy




FIG. 8. DIVISIONS OF THE GREAT WESTERN HIGHLAND

Range," as the name indicates, has been and is of the greatest importance to the country. It was in these mountains that gold was first discovered in California; and it was to find the hidden riches that the great rush to the West, which is described in the chapter on Gold, was begun in '49. Many, however, who went to find gold, remained because of the riches yielded by the fertile soil. Many cities and towns which nestle close to the mountains owe their birth to the mineral resources, but their wealth to-day comes not so much from the gold which is mined as from the rich farms where fruit, wheat, and cattle are raised.

North of Mt. Shasta in northern California the range takes the name of the Cascade Mountains from the numerous cascades and falls in the Columbia River where it works its way through the highland. This range consists chiefly of extinct volcanoes, of which Mt. Shasta is the most noted. It is a grand sight as it rises tall and snow-capped from the dark forest area which surrounds it.

Between the Sierra Nevada and Cascade mountains on the west and the Rocky Mountains on the east lies the Great Basin, so named because it is hemmed in by great ridges on either side. The name must not deceive one, however, for the Great Basin is not a lowland, though parts of it lie below the sea level. The greater portion of it is a high plateau crossed by ranges of mountains. The Great Salt Lake and many smaller lakes lie within its boundaries. There are also vast gray stretches of barren land, where one may ride for miles without seeing a shrub or a tree; there the rivers never flow to the ocean, but lose themselves in depressions or "sinks," the remains of much larger lakes.

Travel through the Great Basin is very unpleasant. In summer the heat is intense, ranging from one hundred ten to one hundred twenty degrees. But the air is pure and dry, and even in the great heat sunstrokes are almost unknown.

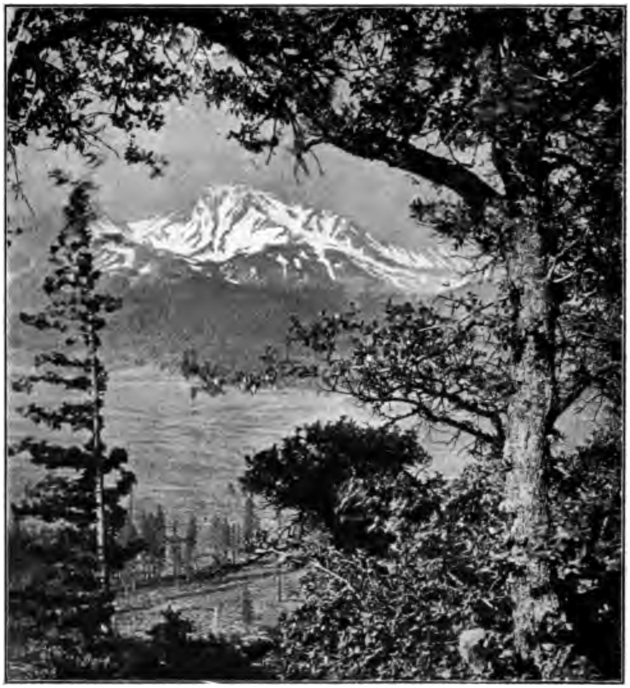

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FIG. 9. MT. SHASTA

If a traveler should try to quench his thirst with water from the rivers, he would find it brackish and disagreeable. Indeed, it is doubtful if he could find water, even if the river bed lay right in his path, for few streams last through the

year. When the snows melt on the mountains, the channels are filled with rushing torrents, and lakes can be seen dotting the landscape. But a few weeks afterward, dry hollows mark the places where the waters of the lakes shone, and a gully of rocks is all that is left of the river.

The Humboldt River is the largest stream of the Great Basin. Its brackish waters flow for three hundred fifty miles through this uninviting country, finally reaching Humboldt Lake, the largest of the deep depressions or sinks which are scattered over the surface of the basin.

Yet we should be doing the country a great injustice if we were to picture it all as a useless desert. The water which would run to waste when the mountain snows melt is now being stored in huge reservoirs and is used to irrigate the land. Thousands of acres in this vast area have been thus reclaimed; and the government is carrying out other projects also, which, when finished, will make farming possible in regions where to-day only the cactus grows. In certain sections salt, which has remained in the dry beds of ancient lakes, is being shoveled up by the carload, and well repays the owner of the land. Borax and sulphur also are obtained in considerable quantities. So you see that the surface and soil of the desert, as well as of the fertile farm lands, determine the products.

South of the Great Basin lies the Colorado Plateau, named for the river, which by ceaseless work through long ages has made for itself a wonderful cañon bed.

North of the Great Basin is the Columbia Plateau, a lava region, probably the largest area in the world which is covered so completely and so deeply by the flow from ancient volcanoes. This area includes much of Washington, Oregon,

and Idaho. Through many centuries it has crumbled into a fertile soil, which, with the moist winds from the Pacific, has made possible the great wheat farms and the forests of dark firs for which these states are noted.

If you look at Fig. 8, you will see that a low range, called the Coast Mountains, skirts the western border of Washington, Oregon, and California. The valley lying between this range and the Sierra Nevada and Cascade mountains is very fertile. The soil washed down from the highlands and the moisture brought by the westerly winds help to make it one of nature's gardens. You will read more of its wonderful fertility in the chapter on Fruit.

As the rivers in this section afford some of the grandest scenery in the world, and as they differ from the streams in the East and the South, let us notice some of their characteristics.

In the Rocky Mountains rise some of the longest rivers in the country, the Columbia, Colorado, Rio Grande, Arkansas, Missouri, and others. The great water systems of the East — the Mississippi, the Great Lakes, the Hudson-Mohawk, and others — were the means by which that part of the country was explored and developed. In the West, however, the railroad early became the commercial agent, and many cities and towns owe their development to that factor rather than to the rivers, many of which are unnavigable.

The crest of the Rocky Mountains is the great divide of the country. It sends some rivers, as the Missouri and the Arkansas, to join the Mississippi and thence to continue their journey through level plains and fertile valleys to the Gulf of Mexico. Others, like the Columbia and Snake

rivers, find their way to the Pacific Ocean over the greatest lava plains of the world. The Colorado, most wonderful of them all, works its way to the sea from its source in the melting snows of the Rockies through a high plateau in which it has cut a cañon two hundred miles long and, for a part of that distance, a mile deep. Few rivers join it in its lonely journey through the desert; indeed, in all the world no other river of its size, except the Nile, flows for so great a distance without a tributary. It is a dashing, foaming, impetuous stream, many hundred feet below the surface of the land, held in its place by vertical walls of rock. No life-giving water refreshes the parched land around, and one might perish of thirst within sight of its waters. No boats float down its surface bringing the people along its banks into closer communication. One might stand on one side of the mighty cañon and see home and friends on the opposite side eight or ten miles away, and yet find crossing impossible. Instead, the wanderer would have to journey hundreds of miles before he could cross to the other bank. There are

FIG. 10. RAILROADS OFTEN FOLLOW RIVER VALLEYS

hundreds of cañons in this part of the country, yet none can compare with that of the Colorado.

The section of the United States which most vitally concerns us is the Central Plain, the valley of the Mississippi River. Within this plain lie twenty-two states, covering nearly one half the area of the entire country, a region large enough to include all the countries of Europe except Russia. Mr. Roosevelt says of it: "The Valley of the Mississippi is politically and commercially more important than any other valley on the face of the globe. Here, more than anywhere else, will be determined the future of the United States, and indeed of the western world."

This great area, stretching from the Rockies to the Appalachians and from our northern to our southern boundary, is the "bread basket" of the country, from which is obtained most of the food and much of the clothing material for our eighty million people. The center of our cotton lands to-day is in Mississippi, that of our manufacturing area in Ohio, and that of our grain products and our population in Illinois, all lying in the Central Plain. As you read in the following chapters of immense wheat farms, of corn lands reaching as far as the eye can see, of the greatest cattle ranch in the world, of a cotton plantation large enough to need several miles of private railroad to reach its borders, remember that all these are made possible by the size, surface, climate, and soil of this wonderful plain.

The "Misse-Sepe," as the Indians used to call it, is the most wonderful river in the world. And yet it has no mighty falls like that African river, the Zambesi, whose torrent falls over a precipice four hundred feet high, making the highest great fall in the world. Nor has it carved a

mighty cañon like the Colorado River. Unlike the Rhine, it has no grand castles on its banks to be visited annually by thousands of tourists. Wherein, then, do its wonders consist?

In the first place, the river itself with its largest branch, the Missouri, makes the longest river in the world. It receives the water from more than fifty navigable rivers, and from hundreds of others not navigable. On the navigable branches one might sail for a distance nearly equal to the circumference of the earth. Flowing as they do through a fertile soil and temperate climate, they afford more opportunity for navigation and development than any other system in the world.

The two greatest branches of the Mississippi are the Ohio and the Missouri, connecting the main stream with the eastern and western portions of the great Central Plain. The Missouri, hurrying from its source three thousand miles away, pours every second into the Mississippi one hundred twenty thousand cubic feet of water. It eddies and swirls and foams as if in anger that it cannot immediately turn the blue waters to a color as muddy and tawny as its own. But for miles the clear northern stream flows pure and blue beside its yellow tributary, until at last their waters mingle, and then as one river they make their way toward the Gulf.

About one hundred fifty miles farther down the Mississippi we come to its junction with the Ohio. This river discharges more water into the trunk stream than any other branch, not excepting the Missouri, though that is three times as long as the Ohio. But the Missouri drains a country where the rainfall is very light, and that which falls soaks into the parched ground, or quickly evaporates in the

dry air. So we are not surprised to know that the great floods of the lower Mississippi, which do such damage to shipping and farming, are due largely to the rising of the waters of the Ohio and its branches.

The height of the water in the Ohio often varies from three or four feet in the dry season to fifty or more in the spring when the snows melt on the hills and mountains. The level of the water is regulated somewhat by a system of dams and locks, which make a kind of canal out of the river in certain places. In this way a level of six feet has been maintained, and plans are now on foot to further improve the navigation of this river and render it useful to larger boats.

### Topics for Study

1. On an outline map show the routes by which colonists gained the Central Plain.
2. Make a list of eight rivers whose waters reach the Atlantic; of at least six which have their source in the Rockies; of five branches of the Mississippi. On an outline map show all these rivers.
3. Make a list of the states which each flows through.
4. Locate the Nile, the Zambesi, the Rhine. Find, if you can, some interesting facts about each one.
5. Name the divisions of the Western Highland in their order from the ocean; of the Eastern Highland. Locate these divisions on a map. Sketch the "fall line." Write a list of cities situated on it. Find out, if possible, what each city manufactures, and tell why these products are made there.
6. Name in order, beginning at the north, all the bays and harbors you can find on the Atlantic coast. In what state is each one? What river or rivers flow into each? What city or cities are situated on each? Locate bays, harbors, rivers, and cities on an outline map.
7. Write an explanation of the formation of drowned valleys.
8. Locate Yellowstone Park and Colorado Cañon.
9. Describe the wonders of each.

**10.** Tell the story of Sheridan's ride through the Shenandoah Valley.

**11.** Do you know the poem about it?

**12.** See if you can find the answers to the following questions:

*a.* What is the highest mountain in the United States?

*b.* Where is the lowest part of the country? How low is it?

*c.* Where is the hottest place?

*d.* Where are the fewest rivers?

*e.* Where are the largest trees?

*f.* Where are there no trees?

*g.* Where are the glaciers? What is a glacier? In what other countries are glaciers found?

*h.* Name some volcanoes in the United States.

*i.* In what states would you find geysers, salt lakes, cañons, petrified forests?

# CHAPTER IV

## CLIMATE AND SOIL

The position and size of a country, its surface and drainage, affect in great measure the life of the people; and no less important in their effects are the climate and the soil.

Because of the position, size, and surface of the United States we find in it great varieties of climate. Without traveling beyond its boundaries we may go from the subtropical temperature of the South to the almost Arctic winters of the North; from the abrupt changes of the New England states, where hot weather is quickly followed by cold, and heavy rains by droughts, to the balmy winters of southern California, where the temperature varies but little, and where the sun shines from a cloudless sky for weeks at a time. We may visit western Oregon, where nearly ninety inches of rain falls each year, and see its forests of immense trees, fields of waving wheat, and orchards of delicious fruits. Several hundred miles farther south, in southern California, we find one of the driest regions of the world. In Death Valley, a part of the Mohave desert, less than two inches of rain falls annually, and often a year or two passes with no relief from the bright sunshine. A more miserable place cannot well be imagined. No living thing exists here except a few varieties of the cactus plant and some lizards and horned toads. The sun's rays in summer are well-nigh unbearable. Water thrown upon the ground disappears almost instantly, and one cannot bear one's hand upon a stone that

has lain for some time in the sunshine. Although rainstorms are rare, violent sandstorms frequently occur. The clouds of sand are so thick that the sun is hidden. The wind blows with such violence that drifts of the loose soil are piled up ten and fifteen feet high and particles of fine sand cut the skin like a knife.

But you are already asking, "Why are so many varieties of temperature and rainfall found in the same country?"

FIG. 11. WINTER IN SOUTHERN CALIFORNIA

You can answer the question by thinking of the size, position, and surface of the United States.

Our country is very large. It stretches three thousand miles from east to west, and one half of that distance from north to south; and different influences are at work in different parts of its immense area. Its southern limit is not far from the torrid zone, while its northern border is nearly two thousand miles nearer to the frigid zone than to the torrid.

The United States lies in the path of the westerly winds, which prevail in the temperate zones. Warmed by the Japan Current, they blow upon our western shores, bringing the mild, even temperature of the ocean, and making possible

FIG. 12. NIAGARA FALLS IN WINTER

Compare this picture with Fig. 11

the winter roses, geraniums, and fruit orchards of southern California. On the eastern coast the Labrador Current flows southward near to the shore, chilling the land for miles around. Though not so agreeable, its importance to Eastern

people is perhaps as great as that of the balmy Japan Current to California, for in its cold depths great numbers of codfish, herring, and mackerel find food and temperature suited to their development. The cold Arctic stream is as necessary to the life of these fish as rain and sunshine are to the crops of the farmer. Without this current the fishing industry of New England would not be possible.

Nowhere in the coastal regions do we find the extremes of temperature to which the inland states are subject. In summer people like to go to the beaches and ocean resorts, for in the hot season the water is cooler than the land and so lowers the temperature of places near it. In winter the opposite is true, and snowstorms of inland regions often become rainstorms near the coast.

The amount of rainfall in the United States is as varied as the temperature, as you will see if you examine the accompanying map. The westerly winds, full of moisture obtained in their journey over the Pacific Ocean, blow upon the western borders of the country. You know that air when cooled cannot hold so much moisture as when warm. When the hot air from the nose of a teakettle is suddenly chilled by holding a cold plate before it, much of the moisture it contains is deposited upon the plate. In winter the land is cooler than the air from over the ocean, and the moisture is condensed into rain near the coast. In summer the prevailing westerlies have moved farther north, and little or no moisture falls in the southern part of this coast region. Thus in parts of California two seasons prevail, the dry summer and the wet winter.

The Sierra Nevada Mountains, with their cold, lofty peaks, condense much moisture on their western slopes and

the winds that blow over the Great Basin are dry, carrying no refreshing rains to the parched soil. The eastern slopes of the mountains are comparatively bare, while on the western sides we find great forests of the largest trees in the world and fertile valleys green with wheat or yellow with fruit. What little moisture remains in the air after passing over the lofty Sierras is condensed upon the upper western

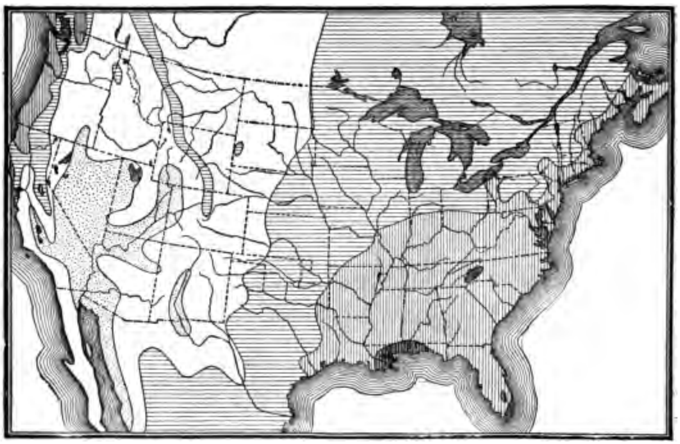

Fig. 13. Annual Rainfall of the United States

Darkest shade, over 80 inches. Lighter vertical lines, from 40 inches to 80 inches. Horizontal lines, from 20 inches to 40 inches. Blank, from 10 inches to 20 inches. Dotted, less than 10 inches

slopes of the Rockies. The regions to the east of these mountains receive no rain from the westerly winds, though they continue their course over the country. In New England pleasant weather is expected when the wind is from the west, while rain is brought by the damp, east winds. The Atlantic Ocean, the Gulf of Mexico, and the Great Lakes furnish most of the moisture for the eastern and southern states.

The greater portion of the country, except the Great Basin region and the plains east of the Rockies, receives sufficient rainfall for agriculture. In the semi-arid regions, where there is a little rain but not sufficient for raising crops, are the great cattle and sheep ranches of the country. In the spring the grass comes up fresh and green, but withers in the dry heat of summer. Its nourishment, however, still remains in the dry stalks and blades. So, although the country looks barren, the cattle find much of their food in the brown grass.

In the arid and semi-arid sections little vegetation is possible without irrigation. Great areas that were formerly parched, barren wastes have been irrigated so that now they are yielding crops of fruit and grain. Hundreds of square miles have already been reclaimed from the desert, and the government of the United States has further plans which will make productive more than ten thousand square miles now practically useless. This is more than is contained in the whole state of Massachusetts. How many farms do you think can be made from this great area?

When the snow melts in the mountains, the rivers, which perhaps later in the year may be wholly or partly dry, are rushing torrents, and great quantities of water run to waste. By building dams this water is stored in reservoirs. It can then be taken great distances through canals and pipes, and used when the dry season comes.

How to obtain a sufficient water supply is a much greater problem in Western cities than for those in the East, for it must in many cases be brought from great distances. The supply must be larger than in the East, for it is used for irrigating as well as for other purposes. In many Western

cities no grass will grow on the lawns and no trees shade the sidewalks without artificial watering, and streams trickling along the sides of the streets are familiar sights there. Los Angeles has made plans to bring water to the city from the western slopes of the Sierras, two hundred forty miles away. Think of an aqueduct ten feet wide and fourteen feet high, long enough to reach from New York to

FIG. 14. VARIETIES OF CACTUS UNDER CULTIVATION

Pittsburg or halfway from Chicago to Buffalo, passing through deserts and cañons and tunnels to bring water to a thirsty city.

Though we often speak of the great deserts in the western part of the United States, very little land is unproductive because of lack of fertility in the soil itself. Deserts are caused chiefly in three ways: by lack of heat, lack of rainfall, and lack of good soil. The great frozen areas of

the polar regions are examples of the first kind. More land is made unproductive by lack of heat than in any other way. Lack of rainfall has caused great areas to be unfruitful which, if supplied with water, would yield abundant crops. Many such desert wastes are disappearing under the hand



FIG. 15. NATURAL BRIDGE, VIRGINIA

of science. The largest barren areas in our own country are deserts of this type. Comparatively little land in the United States belongs to the third class, though some such areas can be found in the Dakotas and in the Great Basin.

In the northwestern part of the country the soil is made

from the lava which overspread the land to a great depth. The soil is fertile and the rainfall abundant, and as a result great crops are produced. There are navigable rivers and deep, safe harbors, so we should expect that much commerce would be carried on. Can you tell what are the chief products and to what countries they are sent?

Much of the fine, dark, rich soil of the Mississippi Valley is the gift of the streams of that region. Its original home

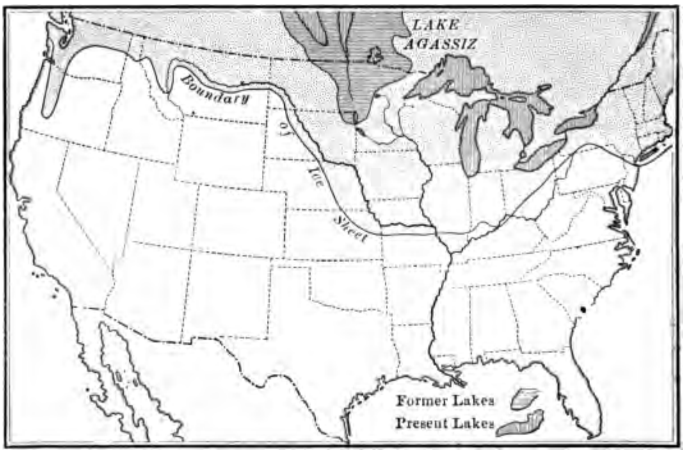


FIG. 16. GLACIATED AREA OF THE UNITED STATES

was in the mountains to the east and west. The rivers have ground it fine and carried it many miles from its mountain home, to lay it down year after year in a thin covering over the plain. All the great crops of wheat and corn, of cotton and sugar, are made possible because of the fertility of this soil.

In the eastern part of the Central Plain, in Kentucky and Tennessee and extending into Virginia, is a limestone

region. The soil is composed largely of lime, obtained through centuries from shells of vast numbers of small animals that lived in the waters which then extended from the Gulf to the Arctic Ocean. Water easily dissolves limestone, and therefore many caves and curious formations are found in this region. The soil of these states is very productive, and the Blue Grass region of Kentucky is famous for the fine breed of horses which is raised there.

All through the northern part of the United States the soil has been affected by the great ice sheet which ages ago overspread this region as far south as the Ohio River and New York City. Much of the soil was scraped along by the glacier, and deposited perhaps many miles from the place where it had lain, and other soil brought from the north to take its place. Sometimes the rock fragments brought by the glacier were soft and easily worn away. In that case we find a smooth, fine soil, as in the north central part of the United States. Sometimes the material carried by the moving ice was very hard and not easily affected, in which case farmers have to struggle with a rocky soil, such as is found on many New England farms.

## Topics for Study

1. In what ways does the position of the United States affect its temperature? its rainfall? Name all the crops you have read of so far. Tell the causes that affect them.

2. Imagine the United States in the position of Mexico and tell what changes would result to climate, soil, and industries. In the position of Canada.

3. Imagine the Rocky Mountain Highland extending from east to west across the southern part of the country, and tell what changes would result.

4. Prepare a paper to convince a European that the United States is more favorably situated than any other country, and has more advantages.

5. Locate Mammoth Cave and the Natural Bridge. See if you can find descriptions or pictures of these wonderful formations.

6. Make a fine map for your school collection by painting white, on an outline map of the United States, the area covered by the glacier.

7. Do you know of any famous summer resorts near the ocean? Make a list of such and locate them.

8. Sketch a map of the United States showing the Japan Current, the Labrador Current, and the Gulf Stream. Can you tell why the warm air over the Gulf Stream affects the climate of our country less than that of Europe?

9. On the same map, write in the part of the country where they are raised the names of all products mentioned in the chapter. Locate also all places mentioned. Make a statement about each one.

10. Explain the lack of rain in the Great Basin; on the plains east of the Rocky Mountains. Which of these places receives less rain? Can you think why this is so?

# CHAPTER V

## WATERWAYS AND RAILROADS

The United States is well supplied with navigable rivers, and railroads are very numerous. Yet so rapidly have our products and manufactures increased that there is much delay in transporting them. Manufacturers complain that they cannot get the material for their factories on time. Dealers in the West receive only after long delay the manufactured goods they have bought in the East. Wheat farmers see their grain, which they have raised with much care and expense, lie rotting on the ground. The great railroads of the country now own more than two million cars for carrying freight. One of the largest roads built in one year more than twenty-five thousand freight cars, and all railroads of importance add to their equipment from five to ten thousand freight cars annually. Yet all these are not nearly sufficient to move the products raised and manufactured each year.

Our navigable waterways are of great help in transporting goods, and many million dollars' worth is carried each year over lakes, through canals, and on rivers. Many plans are on foot to make these water routes more valuable as highways, and much money will be spent in the near future in adding new ones. New York has appropriated the immense sum of one hundred million dollars to improve the Erie Canal, which extends between Buffalo and Albany, so that it will accommodate larger and more modern boats. This

canal and the Hudson River connect the Great Lakes and the Atlantic Ocean. As you read the following chapters you will find out what goods are carried over this route.

A canal in which you will be interested when reading the chapters on Wheat, Coal, and Iron is the "Soo," between lakes Superior and Huron, built to avoid the rapids in St. Mary River. This is at present the most important canal in the world. Several times as much freight passes through

FIG. 17. VIEW OF LOCK IN "SOO" CANAL

it as through the famous Suez Canal, and the traffic is rapidly increasing. There are three locks in the "Soo," one on the Canadian and two on the American side, and plans are being made for still another, so that there may be less delay for vessels. At the present time the lock on the Canadian side is the longest in the world.

Another canal connecting with the Great Lakes will run from Pittsburg to Lake Erie at Ashtabula. Millions of tons of coal are sent through the Great Lakes from Pittsburg,

and a greater quantity of iron comes over the same route to the city. It costs by water less than a tenth of a cent per ton to carry the mineral one mile. For the short journey by rail between the lake and Pittsburg the cost is more than one half of a cent per mile. No wonder that the people of the city have worked long and hard to get such a canal started.

A canal in Massachusetts has been begun, connecting the ocean at Sandwich with Buzzards Bay. In the future a

FIG. 18. "SOO" CANAL

Notice gates to the lock

series of canals may make it possible to go most of the way from Boston to the Gulf of Mexico by inland waterways. It will probably be many years before they are all completed, but let us imagine them already finished and take a trip to the Gulf. The new canal in Massachusetts is the most northerly one. Then a trip through Long Island Sound takes us to New York City, and from there we will go by canal across New Jersey to the Delaware River and into Delaware Bay. A waterway cut across the state of Delaware will take

us to the head of Chesapeake Bay. We will sail down the bay to Norfolk, thence by a series of canals through Pamlico Sound and behind the fringe of islands along the Carolina coasts. Florida can be crossed by a waterway connecting the St. Johns and Suwanee rivers. What an advantage it will be for the United States when all these connections are completed so that vessels can take this shorter, safer route from Boston to the Gulf.

The greatest undertaking of the times is the building of the Panama Canal, which will cut the Western Hemisphere in two. Look at a map of the world and see how much shorter the distance is from the cities on our Atlantic coast to Asia and the Pacific islands if vessels sail through the canal instead of going by the long, stormy route around South America. Since we have come into possession of the Philippine and Hawaiian islands our trade in the Pacific has increased immensely. As you study the following chapters notice what are the chief products which we get from these islands. Can you think what the United States will send them in return?

A great quantity of freight comes from the interior of our country, from the broad, fertile Mississippi Valley. Animal products, grains and flour, and much cotton come from this part of the United States. To reach the great cities on either the Atlantic or the Pacific coast a journey of several hundred miles is necessary before the produce is started on the ocean voyage to foreign markets.

Much more trade could be carried over the Mississippi than at present if the water during many months of the year were not so shallow. This river and its many navigable branches lie in the heart of the fertile West, and before

the building of the great railroads which cross the country from east to west this water route was the chief highway of trade for that section. Plans are on foot to control the waters of the Mississippi and keep them at a higher level, and also to connect them with the Great Lakes.

How is this to be done? Chicago is the largest city of the great Central Plain, indeed, next to New York, the largest city in our country. Many railroads radiate from it, but they alone are unable to handle the millions of tons of freight sent out from the city. The trade through the Great Lakes is very important, but we must remember that these are closed by ice during several months of the year. This throws even more work upon the already overcrowded railroads. If Chicago could ship goods from her very doors down the Mississippi, and out through the Panama Canal to Asia and the Pacific islands, what a fine thing for our country's trade it would be. And this is just exactly what the people of the Middle West are determined shall be done.

Chicago has built a canal connecting Lake Michigan and the Illinois River, to drain the city and carry off the sewage. By making certain improvements in this canal, and by perfecting the plans for making the Illinois and the Mississippi rivers navigable at all times of the year, a fine waterway will be established through the most productive area of the United States. When our government has done this, the Great Lakes and the Gulf of Mexico will be directly connected, and much of the commerce of the Middle West will be directed through the Gulf and the Panama Canal.

Our railroads, however, will probably always be the most important carrying agents. There are great lines of road which lead from the Atlantic coast to the Central Plain,

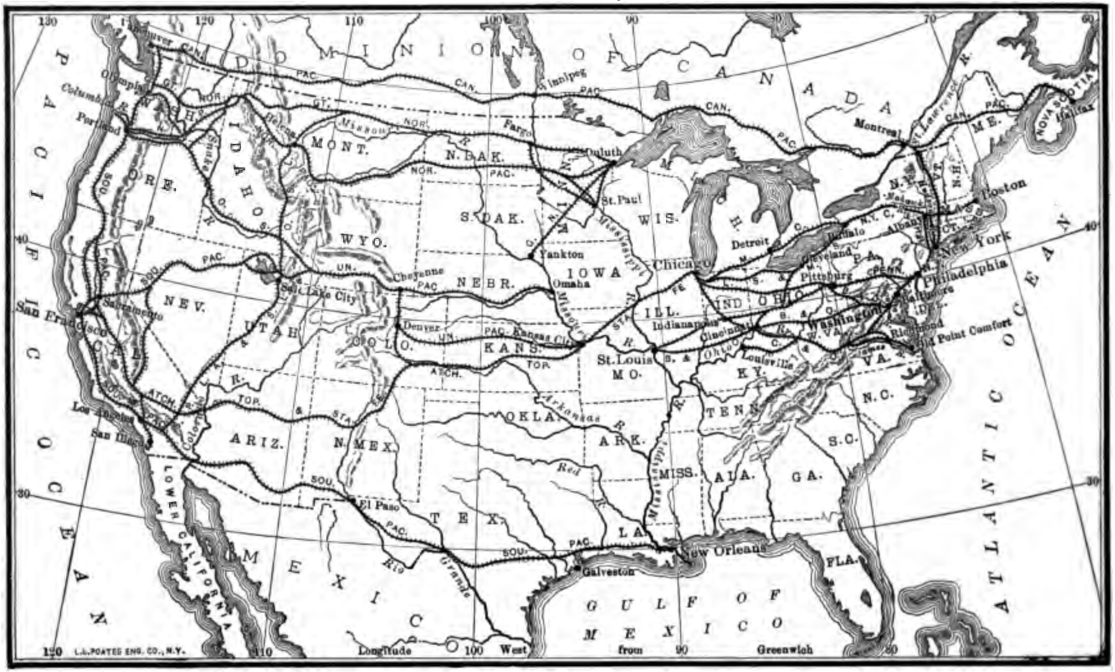


FIG. 19. SOME OF THE GREAT RAILROADS OF THE UNITED STATES

and other important ones which connect the large cities of the Middle West with the Pacific ports. The New York Central, the Pennsylvania, the Baltimore and Ohio, and the Chesapeake and Ohio are some of the roads which lead from the Atlantic coast cities to Chicago and St. Louis, the great centers of the Mississippi Valley. Compare the accompanying map, on which these roads are shown, with the map showing the rivers, and see what river valley each railroad follows in its route over the mountains. These railroads carry millions of tons of iron and coal, beef, pork, grain, lumber, salt, and many other products. These are distributed through the coast region or sent across the ocean to European countries. By these same railroads manufactured and imported goods are taken from the cities near the coast to the Mississippi Valley.

The Great Northern, the Northern Pacific, the Union Pacific, the Southern Pacific, and the Atchison, Topeka, and Santa Fé are among the most noted of the railroads which take freight and thousands of tourists from the Mississippi Valley to the Pacific coast, and bring back the gold, silver, fruit, salmon, lumber, cattle, and other products from California and other Pacific states.

## Topics for Study

1. Name all the rivers that have been mentioned that belong to the Atlantic system; to the Pacific system; to the Gulf system. Put them into an outline map.

2. Find the terminal cities and the states that each railroad mentioned passes through. Indicate the railroads and mark the termini on an outline map.

3. What railroad would you take to go from where you live to Chicago? to Harpers Ferry? to St. Louis? to San Francisco? Plan a trip to some city in which you are interested.

4. If you owned a copper mine in Arizona, over what route would you ship your product? Suppose your copper mine to be in Montana, what route would you use? What railroad might you use if you mined iron in Minnesota? If you mined coal in Pennsylvania?

5. Sketch the Great Lakes and show the route to the ocean via the Erie Canal and the Hudson River.

6. Show the route to Pennsylvania via canal to Pittsburg. Show the route to the Gulf of Mexico via Chicago.

7. Show existing and proposed canals along the Atlantic coast and the Mississippi River.

8. Name the animal products obtained from the Mississippi Valley.

# CHAPTER VI

## COTTON

A visit to the country of King Cotton will take us to the southern part of the United States, where the warm climate, the abundant rainfall, and the fertile soil are most favorable for its production. Though we should find cotton growing all through the South, Texas, our largest state, produces more than any other. There one can ride for hours between immense fields of cotton stretching as far as the eye can see. The dark green leaves of the plant and the snowy bolls of the fiber make a pleasing contrast. In the summer and autumn many colored pickers are scattered through the fields busily engaged in filling bags and baskets with the fluffy balls.

Cotton is the most important crop of the Southern farmers, and early in the spring they are busy with their preparations for planting, which begins as soon as the danger from frost is over. In North Carolina farmers sometimes have to wait until May, but in Texas they usually begin in March. The seeds are planted in rows about four feet apart. When the shoots are two or three inches high, the plants are thinned out, the distance between them being regulated according to the fertility of the soil and to the variety of plant to be grown.

In former years a negro with his mule and plow first prepared the ground and opened the furrow for the seed; then he trudged over the field again to drop the seed, and

a third time to cover it. On some modern plantations all this work is done by one machine, which goes over the field but once, opening the furrow, dropping the seed and the fertilizer, and covering them. Much of the later work

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FIG. 20. COTTON ON WHARF AT NEW ORLEANS

necessary for the care of the plants may also be done by machinery, though on very many farms all the work is still done by hand.

The two chief kinds of cotton raised in the United States are the sea-island and the upland or short-staple variety. The first mentioned receives its name from the fact that it

was originally raised on the islands near South Carolina and Georgia. It is considered the best cotton in the world. Much of it is shipped to Europe and is there made into muslins and other high-grade goods. Most of the American

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FIG. 21. CULTIVATING COTTON, DALLAS, TEXAS

manufacturing is done from the upland or short-staple variety, which is raised in the greater part of the South.

If we were to walk through a cotton field eight or ten weeks after the planting, we should see, peeping out from among the green leaves, the creamy white blossoms, "the lotus flowers of the South." These turn to a pinkish or

reddish tinge and soon drop off. The seed pods, which then form, are about the size of an English walnut. When ripe they burst open, showing the snowy balls of cotton within. It is at this stage that the field presents its most beautiful appearance. You see in the picture the negro pickers, each with his bag or basket crowded full of the soft, white fiber.

The owners of plantations in Texas often begin the picking of cotton about the middle of July. The farmers of the

FIG. 22. PICKING COTTON

more northerly cotton states do not begin picking until the middle of August or later. The amount of cotton raised is limited, not by lack of suitable land, but to a certain extent by the number of pickers that can be secured. This has been the greatest problem of the Southern farmer. The picking of cotton is by far the most expensive work done on a plantation. The recent invention of a machine which can do this work successfully was of as great importance as the invention of the cotton gin, and great

things are hoped from it. It consists of a small gasoline engine on wheels, which travels over the cotton plants about as fast as a man can walk through the fields. Under the machine are many revolving steel fingers,

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Fig. 23. Weighing Cotton

which catch the fiber but which injure neither the plant nor the unopened bolls. This is an important feature, for cotton does not all ripen at the same time. A field has to be picked many times, and at last the frost destroys what is left. The last picking is sometimes done as late as December. It is better to gather the cotton in

this way than to let it remain in the fields until all the bolls are open. A heavy rain would injure the fiber and a strong wind might blow it away.

In walking through the cotton field we find some bolls in which the fiber is not pure and white, and we notice many



FIG. 24. SHIPPING COTTON

Notice size and shape of bale

of the little cases (called squares), which contain the young buds, lying on the ground. Unfavorable weather may cause the squares to fall, or the damage may be done by the cotton plant's greatest enemy, the cotton-boll weevil. The

damage done by this insect in the state of Texas alone has amounted to millions of dollars.

The weevil is a small, gray beetle about one fourth of an inch long. It spreads very rapidly, for the young develop in three or four weeks and it is possible for several generations to breed in a single season. The United States government, through the Department of Agriculture, has realized this great menace to the cotton crop and has appropriated large sums of money to remedy the evil. Many experts have been at work on the problem and have suggested various methods for checking the work of the weevil.

The white fiber of the cotton boll is filled with small, dark seeds nearly twice the size of an apple seed. For many years these had to be picked out by hand. This was a long, slow process, for hurry as fast as he might, a workman could not clean more than a pound in a day. This limited the amount of cotton produced, for only as much was raised as could be cleaned. All this was changed, however, when Eli Whitney invented the cotton engine, or "cotton gin" as it is usually called, by which the seeds are easily and quickly removed from the fiber. The story of the invention is very interesting, but is too long to be told here.

The machine is simple and does its work effectually. It consists of a revolving cylinder on which are rows of saw teeth about one half inch apart. As the cylinder revolves, these teeth catch the fiber and draw it through screens of wire netting, while the seeds drop on the other side. The cotton is swept by brushes from the saw teeth to which it clings, blown by a blast of air into a condenser, and thence carried by rollers to the press. Sea-island cotton is ginned by running it between rollers, instead of through saws as

described above. In this long-staple cotton the fiber does not adhere to the seed as in the short-staple variety, and the work of ginning is much simpler.

In the press room the clean, fluffy cotton is made up into bales which weigh about five hundred pounds. At the shipping cities these are put under more powerful presses and reduced to smaller bulk. In this form they take up less room and are not so inflammable, — a matter to be carefully looked after, as more than half our raw cotton goes on a long journey across the ocean to European countries, while much of the remainder is sent North to be manufactured.

The cotton from the outlying plantations is sent to the village and is there ginned and baled. Most of the Texas product is then shipped to Galveston, the commercial center of the state. The city has a fine harbor and an immense trade. Vessels of many nations find anchorage there, and cotton may be shipped to any of the ports in our own country or in Europe.

Before we embark with our load of cotton, let us go back to the plantation and see what is done with the seeds which were separated from the fiber in the ginning room. The seeds were formerly considered rather a nuisance to dispose of, and were thrown away as waste matter. Now, however, they are considered of much value and are carefully saved. There is an immense quantity of them, as from every pound of lint two pounds of seed on the average are removed. When we speak of the value of the cotton crop, we think usually only of the millions of yards of cloth and lace and thread which are made every year from the fiber. But to-day the seeds increase the value of the crop by millions of dollars.

In many Southern towns and cities, side by side with the ginning plant and the cotton factory, stands the oil mill. There are hundreds of these mills in the cotton belt. In them the hulls are removed, the seeds are crushed, and the oil is pressed out. This is purified and sold in large quantities. One of its important uses is as a substitute for lard or as an ingredient of it. Nearly one third of the cottonseed oil now manufactured, we are told, is bought by packing houses and used in this way. Great quantities of it are shipped abroad and are used in the manufacture of butterine. This is a substitute for butter, which is much used in Holland, Belgium, France, and other European countries.

Pure cottonseed oil is said to be colorless and odorless and to have an agreeable taste, and because of these and other qualities it is every year being used more and more in place of olive oil. Much is shipped to the Mediterranean countries, and, mixed with olive oil, makes a cheaper food for the peasants. On the coast of Maine great numbers of small fish are caught and packed in this oil and sold as sardines. The inferior product which is left after the best quality of cottonseed oil is manufactured is used in the making of soap, axle grease, and other lubricants.

The hulls of the cottonseed, and the meal which is made from the cakes of crushed seed, are used in great quantities as cattle food, and in the South have taken, in a great measure, the place of corn. The Southern farmer can feed his cattle on the product of his cotton fields instead of buying other food. It is said that what is left of a bushel of cottonseed after the oil has been extracted has as much food value as a bushel of corn.

The Western cattlemen are calling more and more on

Enough cloth is made in this city every year to carpet its entire area several thicknesses deep. Large quantities of cotton are used also in the four or five hundred cotton mills in the other cities and towns of New England. Chief among these manufacturing centers are Lowell and Lawrence in Massachusetts, and Manchester in New Hampshire.

It seems strange to find so many cotton mills so far from the place of production. But through most of our history New England has been the manufacturing center of our country. The front of the great glacier, which so many years ago spread over the northern United States, long remained stationary near the New England coast, and deposited, as the ice melted back, great masses of gravel and clay. These deposits were often sufficient to turn the rivers out of their courses, and the efforts of the streams to make new channels have resulted in many rapids and falls. In early days water power was used exclusively for the running of mills and factories, and thus New England soon became engaged in manufacturing even those products which were brought from a great distance.

All this is rapidly changing, however, since other motive power has been developed, and manufacturing is now moving rapidly westward and southward. Several hundred cotton mills are running to-day in the Southern states, North Carolina having the most; and nearly as much cotton is now manufactured in the South as in the North. Here the raw product is close at hand, thus saving the expense of transportation. Labor is cheaper and the mills may be run for longer hours. Many of the operatives are women and children, the latter often entering the mill at an early age.

The manufacture of cotton cloth is a long, intricate process, and the only way really to understand it is to visit a factory and see the work done. There are more than forty processes before the fiber is transformed into cloth. First the cotton is cleaned and carded, and then placed in machines where all the fibers which we saw so tangled in the bolls are laid nearly parallel. Similar processes are repeated several times until the fibers have been laid straight and smooth. In the spinning process the overlapping fibers are drawn out into finer threads and twisted evenly and tightly. The thread is then wound smoothly on spindles. One spinning machine holds several hundred spindles, yet so smoothly does it work that it is tended by only one girl.

After being dyed the thread is ready for weaving. Take a piece of cloth and unravel it. You can see the long warp threads running lengthwise of the cloth, and, woven in and out, in and out, over and back, over and back, the crosswise or woof threads which make the cloth firm and solid. It is of little use to describe the looms which do this work, for unless you have actually seen the operation a written description cannot mean much.

Many people in other countries besides our own are engaged in the raising and manufacturing of cotton, for, although the United States raises three fourths or more of all the cotton grown in the world, India and Egypt are noted also for their production. Both of these countries are under the control of England, and with the cotton which she imports from them, together with the greater quantity sent her from the United States, she has become the largest cotton manufacturing country in the world. Manchester, the center of the industry, is connected with Liverpool by

a ship canal which aids her commerce immensely. All European countries would be glad to be able to raise in their own colonies the cotton they need for manufacturing, and not be dependent for this staple upon a foreign country like the United States.

When we enter a large cotton factory, with its many hundreds of operatives, and listen to the noise and clatter of the machinery, we cannot but contrast it with the days long ago when cotton was cleaned, spun, and woven in the home by the use of the fingers only. But this is only another illustration of the fact spoken of in the opening chapter, that it is no longer possible for one person, or family, or city, or even country to live independently, supplying all needs at home and furnishing nothing for the outside world.

We do not know how long it is since people first began the raising and weaving of cotton. It was probably many years after both linen and wool were used. The plant is supposed to be a native of India, though of that fact we are not sure. When the cloth was first used, it was considered very fine indeed; history tells us of a king who at his coronation wore a beautiful cotton robe.

## Topics for Study

### I

1. A trip to Texas.
2. A cotton plantation.
3. Raising cotton.
4. Kinds of cotton.
5. Picking cotton.
6. Dangers to crop.
7. Cotton ginning.
8. Shipping cotton.
9. Uses of cottonseed.
10. Value of cotton crop.
11. United States cotton belt.
12. Exporting cities.
13. Manufacturing of cotton.
14. Cotton belt of the world.
15. History of cotton.

## II

1. Write a description of the raising, picking, and ginning of cotton.

2. Make a list of all the things you can think of which are made from any part of the cotton plant.

3. Mount on a large card samples showing the uses of cotton. See which row of the class can get the greatest number of articles and mount them in the neatest way.

4. On a map of the world, color the countries producing cotton. Write the names of all the bodies of water on which a vessel would sail, carrying cotton from India or Egypt to England.

5. Describe clearly how the cloth in any cotton garment you have on has been made.

6. Trace a map of the United States and locate all cities mentioned in this chapter.

7. Sketch the states included in the cotton belt. Number each in its importance in the production of cotton.

8. What are some of the sights you would wish to see in a visit to New Orleans?

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this chapter.

| | |
|---|---|
| New York | Kentucky |
| New Orleans | Mississippi |
| Galveston | Georgia |
| Memphis | Alabama |
| Charleston | South Carolina |
| Savannah | Arkansas |
| Norfolk | Tennessee |
| Lowell | New England |
| Lawrence | Southern states |
| Fall River | Cotton region. |
| Manchester, N. H. | Africa |
| Manchester, England. | Asia |
| Texas | India |
| North Carolina | Egypt |
| Massachusetts | All water routes mentioned. |

# CHAPTER VII

## SUGAR

How much sugar do you suppose a person eats in a year in his food and drink and in his candy and other sweetmeats? Statistics show that in the United States every man, woman, and child eats on the average more than seventy pounds a year. This is much more than is eaten by any other nation. Consequently, although we produce great quantities of it every year, we import more sugar than any other product. All the wheat we sell annually to foreign countries would not pay for the sugar we import in the same time.

Sugar cane, which is the best known of sugar-producing plants, was introduced into America by the Spaniards in their earliest voyages. It is a cousin of the Indian corn and closely resembles it. Sorghum, from which some of our molasses is made, is another cousin. Most of the sugar imported into the United States comes from islands of the warm belt where cane sugar is the only kind produced. Therefore we use more of that kind; but we are the only nation of importance of which this is true. Can you name some islands from which we receive large quantities of cane sugar?

The raising of beets for sugar is a development of recent times. This industry has grown so rapidly that now much more sugar is made from beets than from cane.

A third variety is the delicious maple sugar which we all like so much. The amount made is, however, so small as to be of very little importance compared with either of the other two kinds.

These three varieties, cane, beet, and maple sugar, are all made from the sap or juice of vegetable growths in practically the same way, that is, by boiling down and purifying the liquid. The methods differ, but the underlying principle is the same in each.

Still another product which we might class with the varieties of sugar is the honey made by bees from the nectar of flowers. This is probably the earliest form of sugar used by man, the bees thus furnishing the sweetmeat before man had developed sufficient intellect to make it for himself.

Glucose is a liquid sugar made from cornstarch in the United States and from potato starch in France and Germany. It is used for confectionery and preserves and for mixing with molasses.

To see a typical modern sugar plantation let us go to Louisiana, for most of the cane grown in the United States is raised in that state. The plantation which we will visit is larger than the average, and is well equipped with the latest machinery for cultivating the plant and with the most recent inventions for converting the juice into sugar.

Our trip will take us into the same part of the country where cotton is grown, for sugar cane requires for its growth a tropical or warm temperate climate. Taking a train from New Orleans, we are carried farther and farther northward into the heart of Louisiana. For much of the way, on both sides of the track, we see only the fields of waving cane. In places it is so tall that a person on horseback would be

completely hidden from sight. We might think we were in the Kansas cornfields were it not that the cane is taller and has a thicker, heavier stalk.

Mr. Blank's plantation, at which we finally arrive, consists of several thousand acres, the most of which is devoted to



FIG. 25. PLANTING CANE

sugar cane. Some parts of the farm stretch so far away from the sugarhouse that a private railway several miles long has been built, over which the stalks are carried to the factory; we can also follow good wagon roads for miles through the forests of waving cane.

From the overseer we learn something of the methods of planting. The land is first plowed and thrown into ridges from six to eight feet apart. Then a small trench is made in the top of each ridge, and in each trench two or three rows of cuttings from the main stalk are laid end to end. A machine has been invented for covering the cuttings,

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FIG. 26. CUTTING CANE ON A CUBAN SUGAR PLANTATION

though on the smaller plantations this is still done by hand. The expense of planting a large plantation is great, for from four to six tons of cane are required for each acre.

The new shoots spring from the joints of the cuttings, and soon the rich, dark fields are covered with waving, green leaves. The plant grows rapidly under the heat of the southern sun, and by harvest time has attained a height

of perhaps fifteen feet. For several years the cane will spring up from the same roots, but it will gradually become of a poorer quality. Then the old roots are plowed up and new cuttings planted. Where cane and labor are plentiful this is done every year, although in Louisiana the stubble is capable of producing a good crop a second and even a third year.

Harvesting begins usually in October. It is better to let the cane grow just as late as possible, as it is in the latter part of its life that the sugar forms most rapidly; but it must be cut before frost comes to injure it.

Negro workmen, using large knives made for the purpose, go through the fields cutting the stalks very close to the ground. The lower part of the stalk yields the most sugar, so the plant is cut as near the roots as possible. The leaves and tops are trimmed off, and the stalks are laid in piles as the cutter proceeds.

On this large, modern plantation the cane is loaded by machinery and quickly carried to the factory where the juice is to be extracted. From wagons or cars the stalks are thrown upon a moving belt which carries them to the top of the mill. They are first cut or shredded into small pieces and then crushed between heavy rollers. The crushed stalks from which the juice has been removed are used in the furnace, thus saving the cost of fuel.

The juice which has been squeezed out is carried by pipes to large screens through which it is strained. After this it goes through several processes, one of the most important of which is the boiling in large tanks with milk of lime. Boiling causes the impurities to separate from the clear sirup, which is drawn off by pipes into large pans. Here

it is boiled down and crystallized into a brownish mass known as crude or raw sugar.

The sirup or molasses which is left still contains a great deal of sugar, so it is boiled again, and often a third time, in order to obtain from it the greatest possible quantity of sugar. Each boiling results in a poorer quality of both sugar and molasses. The molasses which we use in our homes is that obtained from the first boiling of cane juice, from sorghum, or from a glucose mixture. The molasses which is finally left after the reboiling was formerly considered a waste product, but is now used to a certain extent by plantation owners as a food for cattle.

The raw sugar is next sent to the refinery, where it goes through many processes of boiling, purifying, and filtering, until it finally drops into huge bins. From here it slides down through shutes or spouts into hogsheads, in which it is shipped away for distribution.

The difference in price between raw sugar and the pure, white product after it is refined is less than a cent a pound. The machinery for refining is expensive and the process complicated, so it is done only in very large quantities. Consequently, instead of many small refineries scattered through the South, there are a comparatively few mammoth plants centered in cities to which immense quantities can be shipped from our own sugar area and from foreign sugar-producing countries. Refineries will accordingly be found in our great seaports. The most important ones are situated in Brooklyn, Jersey City, Philadelphia, Boston, Baltimore, New Orleans, and San Francisco. These cities import raw beet and cane sugar from all over the world, and send out the refined product to the distributing cities.

Can you name some of these cities, and find on your map the routes over which much of the sugar will pass?

Louisiana produces the greater part of the sugar crop of the United States. The lowlands of the flood plains and delta of the Mississippi River are especially adapted to this crop. Other lowlands in adjoining states are used for the same purpose; Texas especially is increasing her output year by year. Nearly all the sugar produced in the country is furnished by these two states.

A great deal of cane sugar comes to the United States from island plantations to be refined. Sugar raising is the chief industry both in Cuba and in the Hawaiian Islands, and is of great importance in the Philippines. Of all places where sugar is produced, Cuba holds first rank, though it finds a close rival in Java in the East Indies.

Not only Cuba and Java but the other East and West India Islands raise sugar in great quantities; in fact, it is their most important crop. Most of the work is done by hand, and the amount raised could be largely increased by the introduction of modern machinery. The industry has suffered because of the rapid development of beet sugar and its competition in the market.

Much of the molasses produced in the West Indies is used in the manufacture of rum. This industry has been carried to such an extent in Jamaica, that Jamaica rum is noted the world over.

It is impossible to tell, either by appearance or by taste, whether sugar is made from cane or from beets. If we could test the raw sugar, we could distinguish that which comes from the beet very easily, for it has a disagreeable odor and taste, which are removed by refining.

The history of beet sugar is interesting. It was not discovered by accident, as so many of our useful products have been. It was made after years of painstaking, unsuccessful, and costly experiments. A German apothecary first discovered the presence of sugar in beets in 1747, and soon

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FIG. 27. PICKANINNIES' CANDY STORE

both French and German chemists were at work trying to devise some method by which it could be extracted cheaply enough to be commercially profitable. The problem offered great difficulties, for it is hard to get rid of certain impurities which are found in the juice of the beet. The chemists

attained no great success in their researches until after the beginning of the nineteenth century, when a new impetus was given to the work.

England and France were at war at this time, and as ports were blockaded by the hostile fleets prices of all products were greatly increased. Sugar was sold at a dollar or two a pound. Knowing that the sugar beet would grow well in French soil, Napoleon offered a prize to any one who would successfully demonstrate how sugar could be profitably made from its juice. The result was that before the close of the first half of the century the beet-sugar industry grew to be of great importance in both France and Germany.

Its growth in the United States has been more recent but during the past few years very rapid indeed. This rapid development has been largely due to the aid given by the Department of Agriculture of our federal government and by the various state governments. They have established experiment stations where crops of beets have been raised and sugar extracted by the best and cheapest methods. They have sent seed to the farmers and have otherwise aided in familiarizing the people with this new crop.

Germany is at present the foremost country in the manufacture of beet sugar, producing one fourth of the world's supply. It is the largest industrial staple of that empire, although the German people consume per head only one third as much sugar as we do in the United States. The industry is well developed in Austria, France, and Russia. These four European countries all manufacture more sugar than they use, and therefore export much of the product.

The beets require more care and labor in the raising than some other crops, but the income from them is also greater.

The plowing of the land must be deep in order to supply a uniform amount of moisture to the plant during its growth. Furrows are laid out and the seed dropped by a machine which will sow and cover several rows at once. After this the land must be thoroughly rolled. Soon the plants appear, and must be thinned out by hand, weeded, cultivated, and tended very carefully during their growth. Harvesting is delayed as late as possible, for, as in the case of the cane, the sugar forms most rapidly as the plant approaches maturity. The beets are plowed loose, and then pulled by hand. Boys are employed to "top" them, after which they are sent to the factory. If that is too full to receive them, they are piled up and covered with the tops or with a layer of soil.

Arriving at the factory, the beets are washed and then dropped upon sharp knives which cut them in pieces. They are then soaked in warm water and pressed. This extracts the juice, which, while being boiled down and converted into sugar, goes through many complicated processes to remove the impurities. There are more than sixty factories in the United States where this work is done, and more are being built each year. The states which are the foremost in the manufacture of beet sugar are California, Michigan, Colorado, Utah, and Nebraska, and the industry is growing rapidly both in these and in other states. In Michigan large beet farms may be seen to-day on lands formerly covered by timber. As the forests were cut off, it was found that the soil was suitable for the raising of beets, and the lumber mills and sawmills are being replaced by beet farms and sugar factories.

As it is cheaper to raise the beets near the factories, you would see in the vicinity large fields devoted to that industry.

From three to five thousand acres of beets are necessary to insure product enough for one factory. The sugar-making season comes after the harvesting and lasts for three months or more. At the end of this time the factory is idle

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FIG. 28. TAPPING A SUGAR-MAPLE TREE

save for necessary repairs or improvements. The workmen can usually find employment on the neighboring farms.

In this industry, as in so many others, the waste products are utilized. The pulp of the beet, after the juice has been extracted, has been found to be a good cattle food, and dairies are now being run in connection with some

factories. The beet tops are fed to cattle to some extent, but are more valuable as a fertilizer, giving back to the soil some of the elements taken from it in the growth of the plant, and thus helping to prevent soil exhaustion.

The cane and beet sugar we have all the year round. There is no time when we look forward to a fresh supply,



FIG. 29. GATHERING SAP IN A MAPLE-SUGAR CAMP

as we do in the spring for the first maple sugar of the season. How delicious that must have seemed to those early New England settlers when they first learned, perhaps from the Indians, how to make it!

Maple sugar is made from the sap of the rock, or sugar, maple, and wherever this tree grows maple sugar can be made. At present Vermont, New York, and Pennsylvania

are the states which produce the most. The trees are tapped in the early spring when the sap begins to flow. A hole from one and one half to two inches deep is bored into the

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FIG. 30. MAKING SIRUP IN THE GOOD OLD-FASHIONED WAY

tree, and a spout is inserted; a bucket is hung below, and the sap which collects is emptied every day and carried to the sugarhouse. Here it is strained and boiled down into

sirup or sugar. In the early days of our history the "sugaring off" was a social event of the year. Young and old gathered around the kettles and mingled much fun and frolic with the work of tending the fire and stirring and testing the sirup.

## Topics for Study

I

1. History of sugar.
2. Kinds of sugar.
3. A trip to Louisiana.
4. Cane sugar: the plant; a sugar plantation; manufacture; sugar belt.
5. Beet sugar: history; methods of raising sugar beets; manufacture; area of production.
6. Maple sugar: area of production; manufacture.

II

1. Take the trip from your home town to New Orleans. If your journey is by land, over what railroads will you go? If by water, name the bodies sailed upon and the states passed through or by.
2. On a map of the world, paste pictures of beets or sugar cane on islands or countries where each is grown.
3. Trace a map of the United States and draw a picture of beets, or cane, or a maple tree in the states noted for sugar. Color the states in each section.
4. Locate all cities containing great sugar refineries. Trace routes from islands and foreign countries from which sugar is sent. Try to find railroads over which raw sugar from cities in the United States is sent. Find the railroads by which sugar may be sent from the refining cities to other distributing centers.
5. Compare methods of sugar raising in our own country and in Cuba or Java.
6. Tell all the likenesses and differences you can think of in the beet, cane, and maple sugar industries.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in the previous chapter.

New Orleans
New York
Brooklyn
Jersey City
Philadelphia
Boston
Baltimore
San Francisco
India
Italy
Germany
Austria
France
Russia
England
Louisiana
Kansas
California
Michigan
Colorado
Utah
Nebraska
Vermont
New York
Cuba
Hawaiian Islands
Philippine Islands
West Indies
East Indies
Jamaica
Java

# CHAPTER VIII

## FRUIT

If the people of one hundred years ago could visit the earth to-day, they would find many things of which they never dreamed: instruments by means of which people one hundred miles or more apart can converse, messages sent thousands of miles in a minute, floating palaces for ocean travel, luxurious parlor cars in which we may ride at ease over plains and mountains, valuable crops grown where no rain falls, and other changes that would seem to them miraculous.

Could we come back to earth in some future century, we should, no doubt, find things as strange to us. Could we enjoy a dinner with the people of the future, we should be much surprised at some of the food set before us. We should find ourselves ignorant of the names of some of the fruits and perhaps unfamiliar with the flowers decorating the room. For our dessert we might partake of white blackberries picked from thornless bushes, plums with no stones, or apples without seeds. We might taste of a plum and from the flavor think we were eating a pear. You may smile at the thought, yet some of these strange fruits have already been produced. Experiments are constantly going on by which men are trying to improve the common fruits and to make them capable of yielding more abundantly, to make them hardier and better able to stand frost, to adapt them to many kinds of soil and climate, and, more wonderful than all, to make them produce new varieties.

Of these wonder-workers, the man who is the most noted is Luther Burbank, of Santa Rosa, California. For years he has patiently toiled among his trees and shrubs, carefully transferring the pollen of one flower to the seed vessel of another, and grafting scions on staid, respectable trees, so that one apple tree may bear at the same time many varieties.

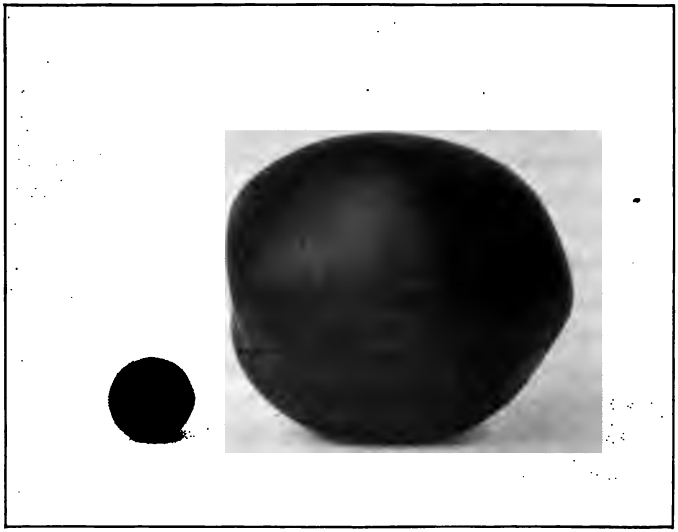

FIG. 31. ONE OF LUTHER BURBANK'S PRODUCTIONS
The large plum has been raised from the small one
(Courtesy of Mr. Luther Burbank)

In this chapter we shall study some of the principal fruits raised in our country to-day; yet in a comparatively few years there may be many others of which we are now ignorant.

In the United States immense quantities of fruit are raised, and there are very few parts of the country where

some variety will not grow. In the desert land the cactus flourishes, bearing its little dried-up fruit. By its sharp spines and thorns the plant is rendered useless to the cattle that would feed upon it. But the wizard of horticulture, Luther Burbank, has developed a thornless cactus with large, juicy, nourishing fruit, so that even these waste portions of our country may be capable in the future of supporting life.

What kind of fruit farm shall we visit first? Out of all the variety which our country affords, we have a wide choice. If we go to the Coastal Plain and the Piedmont Belt of New Jersey, Delaware, Maryland, and Virginia, we shall find many farms where grapes, strawberries, apples, peaches, and other fruits are raised and shipped to the large cities for distribution. What cities in this region would you select as the great distributing centers?

The canning of fruits and vegetables is an important industry, and in Baltimore and Wilmington there are great factories where this work is carried on. See if you can find the names of these or other cities on the cans which your mother buys.

If we go farther south to Florida, we shall probably select an orange grove for our first visit, though we shall wish to see also the farms where pineapples, bananas, and lemons are raised.

If we decide to remain in the North, we shall find immense peach orchards in the vicinity of the Great Lakes, on the eastern shore of Lake Michigan and on the southern shores of Lake Erie and Lake Ontario. The water tempers the climate of this region, and the peaches flourish as well here as farther south in Delaware and Maryland.

Just south of Lake Erie is the Chautauqua grape belt, lying partly in New York and extending into Ohio. From this region alone more than five thousand carloads are shipped each year, most of which are the well-known Concords. The original vine, from which millions have sprung, is still living near Concord, Massachusetts, where that grape was first developed from a wild variety found near at hand. Although we see such quantities of the Concord grape every year, we must remember that it is only one of a thousand varieties grown in our country to-day.

The most wonderful place by far to visit, if we wish to see fruit farms, is California. We can hardly imagine the acres and acres of orange and lemon groves, peach, plum, and olive orchards, and the millions of grapevines which we can find in the fertile valleys of the state. There are besides vast fields given over to almonds, walnuts, figs, apricots, and many other varieties of fruit. A strange sight to Eastern eyes are the great fields, sometimes containing hundreds of acres, covered with trays filled with apricots, peaches, and figs drying in the sun, plums changing into prunes, and grapes into raisins. Such industries are not possible in other parts of the United States, but in southern California no rain falls from May until late October, and in the hot, dry air the fruit dries without decaying. Thousands of pounds of dried fruit, including great quantities of raisins, are shipped every year to other parts of the country.

Perhaps the most wonderful fact connected with this busy industrial life is that many of these fertile farms, fragrant with blossoms, green with grass and shrubs, and with cooling shade trees, were but a few years ago dry, desert wastes. The only thing needed to work the miracle, by

which a desert was changed into a garden, was water. By canals and ditches the life-giving streams are brought from the mountains near by, and presto, change! the desert gives place to fertile farms and pleasant homes.

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FIG. 32. TEN THOUSAND ACRES OF ORANGE GROVES IN CALIFORNIA

San Francisco is the great shipping port for many of these fruits and vegetables, which are sent over the ocean or across the continent. Many vessels loaded with fruits, fresh, canned, and dried, sail from her harbor, and many trains loaded with similar freight leave daily for the East.

## Oranges

Let us first of all visit an orange farm, and see how this fruit, of which we are so fond, is raised and prepared for market. There are three principal areas in the United States where we might find orange groves: in Florida, Louisiana, and California. We will choose California because that state contains more and larger groves than either of the other two. Thirty thousand carloads of oranges have been sent out of the state in one year. What an immense quantity! What large farms and what great numbers of them there must be to produce such an amount.

Redlands is a typical, thriving orange town and contains fifteen factories where the fruit is packed for market, besides a large marmalade factory which makes nearly two hundred and fifty thousand jars of marmalade each season. When we know that nearly four thousand carloads of oranges are shipped each year from this one town, we realize what a large number of groves must lie all around it.

The orange trees are very beautiful with their dark, glossy, evergreen leaves, fragrant blossoms, and balls of yellow fruit. As far as one can see, there are acres and acres of just such trees. When we notice how thickly the fruit hangs on some of them, we are not surprised to learn that one tree has been known to bear ten thousand oranges in a single year. That is not usual, however, for the average tree yields annually only from five hundred to two thousand. The trees begin to bear when about five years old, and continue to produce fruit until fifty years of age and even longer.

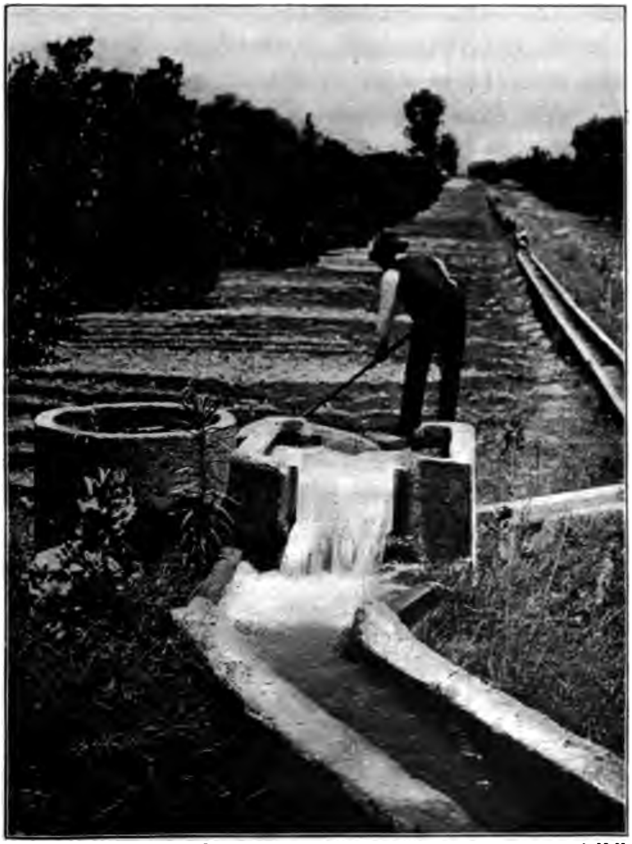

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FIG. 33. IRRIGATING AN ORANGE GROVE IN CALIFORNIA

They are usually planted twenty or more feet apart, in rows, with furrows between for the water, which is let in from time to time to moisten the soil. In southern California the trees grow rapidly and bear early and well, for the

climate is uniform, the average temperature in some places not varying more than eight or ten degrees between winter and summer. There is plenty of sunshine also, for there are usually more than three hundred sunny days each year.

The trees are grown with short trunks, so that the lowest branches hang near the ground. The fruit is picked by reaching from the ground or from stepladders. The picking is carried on chiefly during the winter months, from November to February or March. It is done very carefully, in order that the oranges may not be bruised, for in that case they decay rapidly. Not all the fruit is picked at once, as it does not all ripen at the same time. The picked fruit is taken to a factory, where it is cleaned, sorted, and packed by machinery, ready to be shipped away.

Los Angeles is situated in the center of a region well adapted to the raising of this fruit, and the industry has contributed much to the growth of the city. The oranges which were exported in one year were worth one and one fourth million dollars. The income from this one year's product would be sufficient to give about seven dollars to each man, woman, and child in the "City of the Angels."

Florida used to raise many more oranges than she does to-day; but in 1895 there came a cold wave which extended much farther south than usual and destroyed thousands and thousands of trees. The fragrant white blossoms were turned black, the fruit was spoiled, and even the sap in the trees was so chilled that many died. Thousands of dollars were lost, and the farmers decided to raise in the future crops which would not be so easily injured by frost. Consequently, at the present time Florida is raising a greater variety of fruits and vegetables than ever before. Peaches,

pears, lettuce, tomatoes, celery, potatoes, and other products of the temperate climate are sent out from the state in great quantities. Quick transportation by express and fast freight enables the Florida farmer to send to the North many early spring delicacies, which are now sold more cheaply than ever before. The orange industry has moved to the southern part of the state, where the more tropical productions — bananas, pineapples, and grapefruit — are also grown.

### LEMONS

One of the newest industries in California is lemon culture. The raising of this fruit has long been an important industry in the Mediterranean countries, and in the closing years of the last century we imported from that region several million dollars' worth. Since the cultivation of lemons has been introduced into the United States, we have reduced our importations more than one third, with a future outlook of much greater reduction.

Lemon culture in Florida was given a setback by the freeze of 1895, but many groves in the southern part of the state are still flourishing. The lemon grows most successfully, however, in southern California near the coast. The region is in nearly the same latitude as the southern parts of the Mediterranean countries, and like them receives from the ocean the winds which modify the temperature. Frosts are infrequent, but when they do come are very injurious, and much money is spent in preventing damage from this cause.

The lemon tree is a perpetual bearer, and the fragrant blossoms, the small, green fruit, and the larger lemons

ready for picking can all be found on the tree at the same time. The gathering of the fruit is an interesting process. Every picker has, hanging from his shoulder, a canvas bag with a wire bottom, into which the fruit is dropped. In one hand he carries a knife and in the other, attached to his thumb, he has a steel ring about two and one fourth inches in diameter. Before a lemon is cut from the tree it is measured by this ring, and if it is too small it is allowed to remain until it grows to a proper size.

Many of the pickers in California are Japanese. They are well paid for their work, their wages varying from one to two dollars per day. The pay in the Mediterranean countries is much less. The native pickers of Sicily, for example, receive less than fifty cents for a day's work, while the women sometimes receive as little as ten or fifteen cents. This difference in wages increases the cost of the California lemon, and it must prove itself a superior fruit in order to induce people to buy it.

Lemons are usually taken from the tree before they are fully ripe. They are carefully washed by means of a wheel on the edges of which brushes are fixed. As the wheel revolves, these brushes dip into troughs of water containing the lemons, and thoroughly clean them. All this is done in so careful a way that if the lemons were as fragile as eggs few would be broken. Great care is also necessary in picking and packing, as the slightest bruise causes the lemon to decay much more quickly than if perfectly sound.

After they are washed, they are sorted and dried, and then laid in trays about two feet long and three feet wide but only three inches in depth. These trays are stacked in the curing house, one above the other, allowing air space

between. In these the lemons are left until yellow and fit for shipping. The fruit is sold in much greater quantity in summer than in winter; therefore much of the crop which is picked during the winter months is left in the curing house until the hot season creates a demand. Then the lemons are shipped to all parts of the country, and we enjoy the refreshing lemonade and cooling ices made from their juice.

The California lemon is larger, smoother, and perhaps rather more juicy than its European cousin, and is consequently growing in popularity. The two thousand carloads of this fruit which are shipped annually from the state may seem a small amount compared with the greater quantities of other fruits, but we must remember that the lemon industry is still in its infancy. Its future, however, seems promising, for the climate and soil of California are well adapted to its development.

## Grapes

Scarcely less interesting than the orange and lemon culture is that of the grape, and here again we have a choice of location if we wish to visit large vineyards. As in the orange industry, we find three chief regions in our country where the grape is cultivated. We have already spoken of the Chautauqua grape belt in New York and Ohio, where the Concord grape is raised almost exclusively, and where we might drive for miles between vineyards fragrant with blossoms or loaded with the luscious fruit. If we prefer the small Delaware grape, then we must go to the Atlantic states, Delaware, Maryland, and New Jersey. But if we wish to see great vineyards loaded with huge clusters of white grapes, to visit the fields where tons of these are

being changed by the dry air and bright sunshine into sweet, brown raisins, or to learn about the great quantities of wine which our country is making, then we must stay in California.

The largest grapevine in the world is growing in California. It covers one half an acre, and several hundred people might enjoy its shade at the same time. The main trunk is seven and one half feet in circumference. Think of that, you who think of the grape as a slender, clinging vine. Most wonderful of all, this immense vine bears ten tons of grapes every year!

There is one raisin vineyard in Los Angeles County which covers five thousand acres or nearly eight square miles. This is the largest vineyard in the world, and belonged to Leland Stanford, the founder of the Leland Stanford Junior University. If we reckon three tons of grapes to an acre, which is a modest estimate, think of the immense quantity which is raised on this one farm. Fifteen thousand tons! Now if I tell you that three or four pounds of grapes will yield one pound of raisins, perhaps you can find out how many pounds or tons of raisins come from this one vineyard. And when we think that this is only one farm of all the thousands in California devoted to the raising of grapes and the manufacture of raisins, we can understand better the importance of this industry.

From the pictures of these Western vineyards you will notice how low the vines are. They are trained in this way as it is thought that the fruit grows better near the ground. It is also picked much more easily and quickly if it can be reached without the use of ladders. This manner of growth is not natural to the vine, which, if left to itself, is a great

climber. We read of vines in Italy, which, a historian tells us, grew so high in the trees that the grape gatherer often inserted a clause in the contract which he made with the master of the vineyard, to the effect that, in case of

FIG. 34. GRAPES DRYING, FRESNO, CALIFORNIA

accidents in climbing to such heights, the master should pay for his funeral and tomb. Vines are now pruned closely every year, and the harvest of grapes is gathered from the new shoots. The fruit ripens in August, when it is cut with knives made for the purpose.

Only about one sixth of all the great harvest from the million vines grown in California is shipped as fresh fruit; all the rest is made into raisins, wine, or grape juice. On the Leland Stanford ranch six acres are covered by the wineries in which two and one half to three million gallons of wine are made each year. In these buildings are presses which in one day can squeeze the juice out of four to eight hundred tons of grapes.

If the grapes are to be made into raisins, they are laid carefully in shallow trays about one inch high and nearly a yard square. They are turned from time to time by putting an empty tray upside down over a full one, and then tipping them over. The drying takes from ten days to three weeks, depending on the weather. We must remember that no rain falls from May to November, and much of that time there is not even dew. If it were not for this, grapes could not be made into raisins there, for if the air were damp, or the grapes should be wet, they would decay instead of drying. The fruit which is picked late in the season is sometimes not entirely cured when the rains begin in November. If rain seems probable, there is a great demand for laborers, to re-turn or to cover the trays. Many children are excused from school at these times and work in the fields, thus saving their fathers many dollars. Some firms which cure raisins on a large scale have drying houses, and so escape the danger which comes to the farmer whose trays are in the open field.

After the grapes are dried, they are carried to the packing house and stored in great cases. The little moisture left in them causes them to "sweat," which softens the skin and gives them a better appearance. If they are to be

sold as seeded raisins, they are put through machines which take out the seeds. The fruit is then packed, labeled, and made ready for shipping. California produces one hundred million pounds of raisins annually, and we import about six million pounds more. Of this great quantity we use in our own country about eighty million pounds, enough to give every person in the United States one pound each year. But that is very little compared with the amount used in some European countries: Great Britain, for example, consumes annually five pounds for each inhabitant.

FIG. 35. GRAPES FOR THE WINERY, FRESNO, CALIFORNIA

In the making of wine the grapes are first crushed and the juice is allowed to ferment, after which it is strained and made ready for market. The fruit and juice pass through several complicated processes, but the crushing of the fruit, the fermentation, and the straining are the most important. The thirty million gallons of wine made in this country annually seems an immense quantity, but if we compare it with the product of European countries it is very little, for this is only one fiftieth of the amount produced by France. When we consider that the area in California

which might be devoted to the cultivation of the grape is equal to that in France, we can understand the future possibilities of this industry.

Though at the present time England gets the larger part of her wine supply from the Mediterranean countries, in the future she may be able to depend on her own colonies to furnish her with what she may need. Cape Colony is becoming more and more interested in the production of grapes and makes several million gallons of wine each year. England also imports many fresh grapes, as well as peaches and plums, from her South African colony.

I wonder if you have ever noticed the grapes as they come to us from Spain. You have probably seen boxes of them at the fruit store, packed in what looks at first sight something like sawdust, but which is really the powdered bark of the cork tree.

Perhaps some one of you may be wondering if the little dried currant which we use in cake and puddings is also a dried grape, or really a currant as the name implies. It is really a grape and not a currant at all. It gets its name from Corinth, a city of Greece, where the fruit was originally prepared for market. For this reason they were first called "Corinths," which, as the years went by, became changed by careless pronunciation into the more familiar word "currants." These grapes grew originally on islands in the Ionian Sea east of Greece, and they are prepared for market in much the same way that currants are. If you put one into water, you can see it swell out into something of the shape of a grape though it is much smaller. Currants form one of the principal exports of Greece and great quantities are shipped annually from that country.

## Olives

Those who do not like olives and seldom if ever eat one will be surprised at the quantity of that fruit which is raised and eaten in the pickled form or used for the manufacture of oil. Olive oil is used largely in salads, in the packing of sardines, in the manufacture of soap, and in medicine.

The original home of the olive tree is in the Mediterranean countries, and Italy and Spain lead the world in the production of olive oil.

At a little distance the olive tree somewhat resembles the apple tree. It has, however, a much longer life, for it is not unusual for one to live and bear for several centuries. The olive industry in our country is confined almost entirely to California, and there we shall find the largest orchard in the world, situated about twenty miles south of Los Angeles. This great orchard covers twelve hundred acres, with about a hundred olive trees to each acre, making, as you see, more than one hundred thousand trees on this single farm. As each tree yields two hundred pounds of fruit in a season, you can easily find out how many tons of olives are produced annually. About eight or nine pounds of the fruit will yield one quart of oil, and now you can figure out how much olive oil may be made each year from this one orchard. If you go a step farther, and find out how much this oil is worth at one and one half dollars a gallon, you will have a fair estimate of the income of the owner of the ranch. We must not forget, however, that he has a large outgo in expenses.

The olives to be used for pickling are gathered when quite green. This work is done carefully, to avoid bruising

dependent on one industry, the cultivation of plums and curing of prunes. It is hard to realize that the tough, dry prune as it comes to us from the store was once the fat, juicy plum. Perhaps it is still harder to realize that more than one hundred million pounds are consumed in the United States annually, making, on an average, more than

FIG. 36. PRUNE GRADER

a pound of prunes each year for every inhabitant. The majority of these are furnished by California orchards. The Pacific Northwest, including Washington, Oregon, and Idaho, is becoming an important prune-growing region and ranks next to France in the amount produced. Before this industry was developed in our own country, we obtained our supply largely from France and the Danube valley, but

now we are able not only to furnish prunes enough fo. home markets but also to ship some abroad.

The plums ripen in the early fall, and if you were to visit an orchard at that time you would see the busy farmers shaking the fruit upon large sheets spread underneath the heavily laden trees. Loads of plums are taken to the factories, where they are first washed and graded according to

FIG. 37. PRUNE DRIER, CALIFORNIA

size; then, after being dipped in boiling lye to soften the skins, they are spread out in the sun to dry. Thousands of trays filled with the fruit may be seen in a single field. The drying requires about a week, though the time depends somewhat on the weather. The dried plums are then stored in the factory, where they lie in large bins for two or three weeks, until they begin to "sweat," which softens and

moistens the skin. Then they are packed in boxes for the market by women and girls, who become very skillful in this work.

There are many different grades of prunes, from the smallest, one hundred forty to the pound, to the largest size, thirty-five or forty to the pound.

### Peaches

Though many peaches are raised in California, the greater part of the crop comes from more eastern states. The region near the Great Lakes is favorable to their growth, and they are raised in large quantities there. Another area lies on the Atlantic seaboard from Connecticut to the southern boundary of Chesapeake Bay. A third lies in the southern Atlantic region in the higher land of Georgia, Alabama, and adjacent states. A mildly temperate climate seems best suited to this fruit, and as it is so perishable it is necessary that the orchards be not too far distant from the markets. If we would receive the peaches fresh and sound for table use, they need to be packed quickly and closely, and sent by fast freight to the cities which serve as distributing centers. What large cities in or near each of the peach areas would you select as such centers?

The peaches are usually picked before they are fully ripe, in order that they may reach the market in good condition. They are sorted according to size, and then go to the hands of the packer. Unless we examine a basket of peaches very carefully, the packing of the fruit would seem to be a simple process. But if we should attempt it we should find it very difficult for our inexperienced hands to arrange the fruit so that it would not loosen and become

damaged by rubbing. The price paid for packing is about two cents a basket, and an expert workman can pack one hundred a day, but we should find that one half or one fourth of that number would be a hard day's work at first. There are systematic ways of packing the fruit, the one best suited to the peaches and to the basket being decided on by the packer. Many girls and women find employment during the peach season, preparing the fruit for market, and often prove more expert than the men.

In the height of the season refrigerator cars are kept at the stations in the peach districts or at the large orchards. These are filled as quickly as possible and started off. On one large peach farm in the South, sidetracks allow cars to be loaded directly from the orchard, and two and sometimes three cars are packed, sealed up, and started for market before eight o'clock in the morning.

### Apples

Of all the fruits that have been mentioned in this chapter none equals the apple in importance —

> The sweet, juicy apple,
> The luscious, red apple,
> The old Baldwin apple,
> That grew on the farm.

The early home of this fruit was in southeastern Europe and in the adjoining parts of Asia, and from there it has been carried to every part of the temperate zone. An apple orchard would be a familiar sight in whatever country we might travel, but more fruit is raised in our country than in any other. Next in rank comes Canada, then Austria-Hungary, Russia, and Germany in the order named. Forty

or more million barrels are produced each year in the United States, an average of half a barrel to every one of its eighty million inhabitants. Large quantities of these are shipped to other countries. What European country do you think would import the most from the United States and Canada? The province of Ontario is the garden of Canada, and one third of all the apples imported by Great Britain comes from that province and from Nova Scotia. In our own country, New England, New York, and the region spreading west and south from these states is the great apple-producing section, though apple orchards are found in every state. A great industry in New York is that of raising young trees for sale, and famous nurseries are found in many parts of the state.

There are fewer disadvantages connected with the apple industry than with the raising of any other fruit. The tree is hardy, requires little care, and is not easily injured; there are many varieties of the fruit and all keep well; the marketing, therefore, is not attended with so much expense as the shipping of more perishable articles. Apples may be put to many uses; they can be eaten raw, or cooked in a variety of ways; they can be dried, or evaporated, or made into jelly, and so kept for an indefinite period of time.

In large factories for the drying of apples there is little waste, for the cores and skins are used for jelly or cider. There would be less material to be used in this way if the apple had no core, for in removing it a large part of the fruit is wasted. Since we can have seedless oranges, why not coreless apples? For many years men have been experimenting to breed an apple without the core. These experiments now seem likely to prove successful, for such

an apple has really been developed, and the trees have been tested by several years of bearing. Nurseries now supply these young trees for planting, and this variety will probably be grown in great quantities in the future. Besides the advantage that there is less waste to the fruit, it is thought that insects will be much less likely to injure it, for some species live in the core itself.

## Topics for Study

### I

1. Modern inventions and experiments.
2. Luther Burbank and his work.
3. Fruit areas of the United States.
4. California as a fruit state.
5. Orange culture.
6. Lemon groves.
7. The grape and its products.
8. Olives and olive oil.
9. Plums and prunes.
10. Peach packing.
11. Apple orchards.

### II

1. Write the names of all fruits mentioned in the chapter, and beside each one the name of the states and countries most noted for its production.

2. Make a collection of labels from cans and preserved fruits. Locate on an outline map all cities mentioned on such labels. Locate also on the map all cities mentioned in this chapter.

3. On a map of the United States, color the grape belt, the peach belt, the apple belt, and the orange belt. Make a list of states producing each fruit.

4. On a map of Europe, write names of fruits in the countries producing them.

**5.** Re-read Chapter IV. Tell cause of arid and semiarid sections of the United States. Tell of the government's plans for irrigation. Tell where fruit may be raised when these plans are carried out.

**6.** On an outline map of the United States, trace the railroads over which fruit may be shipped to the East from San Francisco.

**7.** Ask your grocer for some powdered cork for the school collection.

**8.** Trace a voyage from Cape Colony to England. How far is it? How long do you think such a journey would take?

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in the previous chapters.

| | | |
|---|---|---|
| Great Desert | Corinth | Connecticut |
| Coastal Plain | Japan | Georgia |
| Piedmont Belt | Cape Colony | Alabama |
| Chesapeake Bay | Canada | New York |
| Chautauqua County | Ontario | New England |
| Great Lakes | Nova Scotia | |
| Mediterranean Sea | | Philadelphia |
| Ionian Sea | California | Boston |
| Danube River | New Jersey | New York City |
| Sicily | Delaware | Jersey City |
| Italy | Maryland | Baltimore |
| France | Virginia | Concord, Mass. |
| Spain | Florida | Redlands |
| England | Ohio | Santa Rosa |
| Great Britain | Louisiana | San Francisco |
| Russia | Massachusetts | Los Angeles |
| Germany | Oregon | San José |
| Austria-Hungary | Washington | Chicago |
| Greece | Idaho | Buffalo |

# CHAPTER IX

## WHEAT

History tells us of a speech made by an Indian chief to his people, which is interesting because it shows that even the Indians appreciated the tremendous advantage held by the white people because of their knowledge of the cultivation of wheat. The speech runs as follows:

> Do you not see the whites living upon seeds, while we eat flesh? That each of the wonderful seeds they sow in the earth returns to them a hundredfold? The flesh on which we subsist has four legs on which to escape, while we have but two with which to pursue and capture it. The grain remains where the white men plant it and grows. With them winter is a period of rest, while with us it is a time of laborious hunting. I say, therefore, unto every one that will hear me, that before the cedars of your village shall have died down with age, and the maple trees of the valley have ceased to give us sugar, the race of the little seed eaters will exterminate the race of the flesh eaters, provided their huntsmen do not become sowers.

Nearly every one of the states raises wheat to some extent. Among those in which it is a leading industry, North Dakota holds high rank, and we shall find a visit to one of its extensive wheat farms very interesting. There are large areas in the state where we can see but little else, for there are no high hills, no stone walls, no large maple and elm or other trees to shade the dusty road which winds through the fields of grain. If we come to Dakota in July or August, we can see, stretching for miles on either side, fields of waving wheat. The farm which we will visit raises little

else on its ten thousand acres; its broad fields join those of the next farm, and then beyond that come the acres of yellow wheat of the one next adjoining, and so on, until the expanse of waving grain reminds us of the ocean in its limitless area and constant movement.

The land is plowed in the fall by a machine which can turn six furrows at once. Early in the following spring it is harrowed to smooth and pulverize the soil, and then it is ready for the seeding, which is done by a drill. Such a

Fig. 38. Plowing the Wheat Field

machine will seed from ten to twelve acres a day, with an average of a bushel of seed to the acre. How many bushels will be required for this farm of ten thousand acres?

When the wheat is ripe, there is a great demand for men and machinery, since every one wants the crop harvested at about the same time. After coming to maturity the grain ripens quickly, in from three to six days, and a delay of a few days in harvesting might cause damage to the extent of thousands of dollars.

Think how long it would take one man with a cradle like that in the picture on p. 115 to cut all those acres and acres of wheat. With the development of these great Western farms, many changes have taken place in farm machinery. One machine, which is used for harvesting the wheat, is wonderful indeed. It cuts the grain, lays it even, and ties up the sheaf. Men follow to stack the bundles in such a way that the rains will run off instead of soaking in and wetting the grain. On

FIG. 39. REPLOWING WITH STEAM OUTFIT IN VALLEY OF CALIFORNIA

some of the great California farms the combined harvester and thresher is used. This single machine cuts the grain, threshes out the seed, winnows it, and puts it into sacks.

In Dakota the grain has to remain in the field for some time before it is threshed. In a good season this drying process takes about three weeks. The seed is then threshed out and cleaned by steam threshers. Twelve hundred to fifteen hundred bushels of wheat can be prepared in a day by one of them.

The harvest period is the time to appreciate the magnitude and importance of the wheat industry. It is the great "rush season" of the West. Men of all classes — tramps, clerks, business men, and college students — flock there by thousands. Many railroads running into the wheat belt carry laborers for half fare, and sometimes, when the demand is very great, they are carried free, so important is it that the grain which supplies the bread of the nation shall be safely garnered. The failure of one wheat crop means

FIG. 40. HARVESTING ON A BIG FARM
(Courtesy of the Holt Manufacturing Company, Stockton, California)

debts and mortgages for the farmer, while a successful year brings happiness and plenty.

The housewives in the wheat belt are kept busy providing for this hungry crowd. The harvesting machinery is in full swing. Soon the railroads are crowded with freight. Granaries are filled, awaiting the time when wheat shall be sent to the elevators to be stored until it can be made into flour. The mills in the large flour-manufacturing cities are running at full speed, for millions and millions

of bushels of wheat are waiting for room in the snugly filled elevators.

Some of these grain elevators are immense steel structures holding three or four million bushels. The grain is run into the lower part of the building in freight cars. It is taken from them by huge shovels which need only a few minutes to unload a whole car. It is then lifted to the top of the elevator by means of basketlike arrangements attached to

FIG. 41. WHEAT STACKS

an endless chain. As the chain runs over the wheel in the very highest part of the building, the baskets are turned upside down, and the grain falls into a long chute which carries it to the desired bin. There are openings in the bottoms of these huge bins, from which the grain may be taken when needed. The machinery of some of the great elevators in Buffalo is operated by electricity from Niagara Falls. Can you tell why such large elevators are located in that city?

From the elevator the grain is taken to the flour mills, where it is first examined by inspectors. The men look for dust, oats, and other foreign matter, test the quality by feeling, weigh a portion to see that it is up to grade, and, by means of a long tube thrust deep down into the wheat in the car, find whether or not the lower layers are of as good a quality as those which are near the surface.

FIG. 42. GRAIN ELEVATOR, SOUTH SUPERIOR, WISCONSIN

In a large flour mill the grain is taken from the train by great steam shovels, which can empty a car of one thousand bushels in a few minutes. The wheat is then cleaned and crushed slightly between rollers, after which it is carried to large sieves, where the undesirable parts are separated from those containing the food elements. The rolling and sifting takes place many times, as the grain is crushed finer

and finer. There is a final sifting in which any dust or dirt that may still linger in the flour is caught in a dust collector made of a series of flannel tubes, and the flour is at last ready for packing and shipping. Before this stage is reached, it has been raised to the top of the building ten or twelve times, and as many times has poured down through chutes or tubes to just the right place to continue its transformation into flour. Finally, as a result of all these processes, we have the flour made of the most nourishing parts of the seed.

People who have studied the grains of wheat carefully through powerful microscopes have discovered that the white center is nearly all starch, while outside of this is a yellowish coating of gluten. The starch and the gluten are the nourishing elements, and the parts containing these are used for the best flour. The outer coverings or husks are made into bran or shorts.

How different is the wheat harvesting of the present, with the great steam threshers and harvesters, from that of ancient days, when the grain was cut with reaping hooks! What a contrast between our immense mills filled with their noisy machinery, and the methods used in the olden times when women ground the kernels between two stones! What would the reaper and the grinder of those early days think if they could stand for a few moments in a Dakota harvest field, or follow the grain into a Minneapolis flour mill?

There are six hundred flour mills in Minnesota, beside many others in adjacent states. Duluth, St. Louis, and other cities are noted for this industry, but Minneapolis is the largest flour-producing center of the world. The city

is situated upon the Mississippi River, just where the Falls of St. Anthony furnish power for this and other manufacturing. There are many railroads radiating in every direction, over which the wheat comes pouring into the city, and by which the flour is distributed to a hungry world. In Minneapolis is the largest flour mill in the world, in which fifteen thousand barrels can be manufactured in one day.

FIG. 43. STEAM HARVESTING OUTFIT

The same company which owns this also owns and runs four other large flour mills, three of which are in Minneapolis. The total daily capacity of all these mills is more than thirty thousand barrels. Think of all the other companies engaged in the same business in Minneapolis and other cities, and you will be astonished at the quantity of flour produced every day. Think of the immense number of cars and boats which are needed to distribute through

our own country and Europe all the flour which is manufactured. Think, too, of the great area of land which must be used for the cultivation of this one product.

All the states engaged in this industry do not raise the same variety. Winter and spring wheat are the two great

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FIG. 44. HARVESTING WHEAT WITH A CRADLE

classes into which this grain is divided. The winter variety is planted in the fall and harvested in the early summer. Spring wheat is planted in the spring and harvested in the autumn. Winter wheat requires a mild climate and is consequently raised in the middle and southern sections of

the United States. When the spring wheat was found to be valuable, the industry spread farther north beyond the boundaries of the United States into Canada. To-day twenty-five states and territories raise winter wheat, nineteen produce spring wheat, while some states raise both.



FIG. 45. NATIVE WOMEN GRINDING WHEAT IN PALESTINE

The leading crop producers of the winter variety are Kansas, California, Texas, Ohio, Michigan, Maryland, Nebraska, and Tennessee. Of the spring wheat list, Minnesota, North and South Dakota, Washington, Wisconsin, and Iowa are the most important.

It has been found that the spring wheat requires for its ripening, not so great intensity of heat for a short period, but length of daylight and a milder warmth. As one goes north in summer the days grow longer: consequently the production of wheat has been carried farther and farther northward. Southern Canada is now one of the greatest wheat-producing regions of the world. Thousands of farmers from the United States have sold their farms at good prices and gone to Canada, where they have taken up undeveloped land which can be bought at a low figure.

In Manitoba and provinces farther westward, conditions favor the raising of a very fine quality of the grain. And there in western Canada lies one of the greatest wheat-producing regions of the future. Compared with the United States, few railroads are found in this part of Canada. In fact the wheat is now carried to the East almost wholly by one road, the Canadian Pacific and its branches. The new trans-Canadian railroad is to extend all the way north of the Canadian Pacific, and will be of immense importance in the development of western Canada. Starting from Montreal and Quebec, it will run directly west through the wheat and timber land south of James Bay, cross the rich grain lands of the Peace River valley farther west, and terminate at Port Simpson in British Columbia, one of the very best harbors on the Pacific Ocean. During its whole course it lies within the wheat area and entirely in Canadian territory.

You have perhaps heard of the peasants of Russia, of their hard life on the great plains of that country, and of the terrible famines when their crop fails. Their hardships are not caused by lack of fertility in the land, for the "black

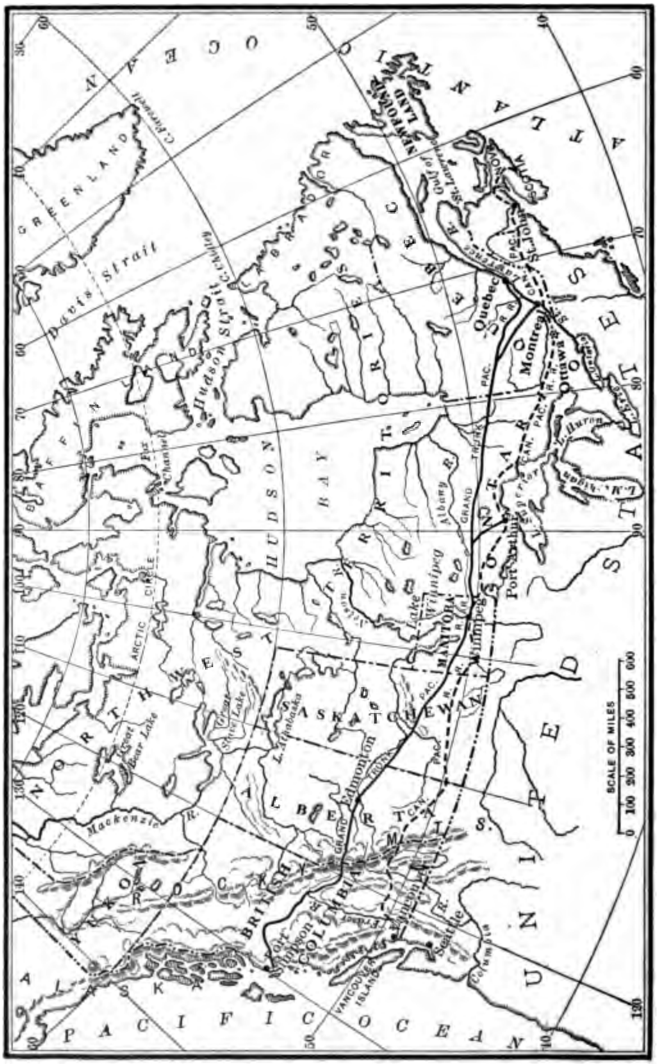


FIG. 46. GRAND TRUNK PACIFIC RAILROAD

earth region" of southern Russia comprises a vast area, level, fertile, and, under better management, capable of producing enormous quantities of wheat. But the peasants know nothing of modern machinery. Everything is done by hand in the most primitive way. The ground is never fertilized, and the crops are much smaller than might be produced if modern methods of agriculture prevailed. In spite of all this, Russia raises great quantities of wheat, ranking next to the United States. She sends a great deal to other European countries, much of which should be kept for home use, for the peasants do not have enough to nourish themselves properly. Odessa, on the Black Sea, is one of the largest wheat ports in the world.

We shall have to go to a very different part of the world to visit the third great wheat-exporting country — to faraway Argentina in South America. We shall find there Spanish, Indians, and half-breeds, whose customs and language will no doubt seem very strange to us. We shall find also the temperate climate, level land, and rich soil on which wheat flourishes so well.

The plains in Argentina are called the "pampas." Perhaps you have seen for sale in some city store the tall, feathery, pampas grass. There are many millions of acres in the pampas, over some of which roam vast herds of wild horses, cattle, and sheep. And there are also vast regions covered with waving wheat. As this country is not developed, land is cheap, and people have made fortunes by buying large areas for little money and developing them into successful ranches or wheat farms. In some cases the farming is not so carefully or so scientifically done as in the United States, and consequently the

returns per acre are not so large. Many of the Argentine farmers are Indians or half-breeds, who are not very ambitious. They do not plow deeply or use good seed, and consequently raise light crops. They sometimes prefer to store their wheat on the ground in sacks, and run the risk of its being spoilt by the weather, rather than pay the elevator charges.

Argentina is perhaps better supplied with railroads than any other South American country. The Paraná and Uruguay rivers penetrate the wheat region and by their junction form the La Plata, on which is situated Buenos Aires, which is one of the largest ports on the continent. The United States is interested in the development of the Argentine wheat fields, for, as the production increases, more and more of our agricultural machinery and tools are needed there. Like the United States, Argentina ships large quantities of her wheat to Great Britain and the continent of Europe. Because of this fact, some of our statesmen already see in Argentina a powerful future rival in European trade.

Wheat is also raised in India and in Australia, and from these places some is exported to England. France, Austria-Hungary, and Germany also raise large quantities, but not one of them produces enough to supply the home demand. Therefore we must think of the United States, Canada, Russia, and Argentina as the great exporting countries. In the best of years Europe never produces enough, even including the crops from the vast fields of Russia, to supply her own needs. She is therefore absolutely dependent on the United States, Canada, Argentina, India, and Australia. If an open conflict between the United States and Europe

should ever come, the American might go far toward winning his victory by a mere stoppage of the tide of food. It is then no wonder that the question of the food supply is constantly before the parliaments of Europe, and to a degree that the American who produces enough cannot understand.

There are about fifteen hundred million people living to-day in this great world of ours. More than one third of them, or five hundred fifty million, use wheat for food, and this number is constantly and rapidly increasing. Each man, woman, and child of the great wheat-consuming population eats on the average a barrel of flour annually. Therefore each year there must be raised nearly twenty-five hundred million bushels of wheat to supply the demand. It is hard to realize what an immense quantity this is. It would make a pile as high as a mountain, — literally, a whole mountain of wheat; for, if heaped in the shape of a cone, the pile would extend two miles into the air, and be so large at the base that, if you started to walk around it, you would have to go nearly sixteen miles before you returned to your starting point. Suppose, instead of heaping the wheat into one huge mound, we pile it up into four smaller mountains of equal base with the large one, but only half a mile in height. One of these piles would be made entirely of wheat from the United States, for we raise one quarter of the world's production. Let us divide the pile made of our crop into four smaller ones, each one eighth of a mile high but nearly sixteen miles around the base. It is indeed very hard to believe that such a heap could be made entirely from the wheat which is raised in only two of our states, Kansas and Minnesota.

If the wheat crop is a good one, there is plenty and prosperity the world over. If the crop fails, there is suffering and starvation. Not only in Russia, but in India also, great famines, in which thousands die, often occur because of the failure of the wheat harvest.

It is an interesting fact that wheat is being harvested somewhere in the world all the year round. South of the equator the seasons are the opposite of ours; therefore those countries harvest their crops in our winter months, November, December, and January, and later as we go farther south. In April and May the harvesting season comes to Mexico, and shortly afterwards to Texas and other southern states. Through the succeeding months the reaping and harvesting moves northward, until in September and October the harvests are gathered in Canada, where the northernmost wheat grows.

An important and interesting work going on in our country is the breeding of new wheats. Any improvement which will increase the yield by only a bushel per acre will add millions of dollars to the value of the crop. The making of a new variety of grain is slow, painstaking work, for the pollen from the flower of one plant must be transferred by hand to the flower of another plant, and from the first harvest only a few kernels will result. But the Minnesota State Experiment Station has already done important work along these lines and has succeeded in creating a hardy grain which will withstand disease and extremes of climate. It is also rich in food qualities and will produce more wheat to the acre than any one of the old varieties. The governments of other states and the Department of Agriculture at Washington are also working in the same direction.

## Topics for Study

### I

1. A trip to Dakota.
2. A typical wheat field.
3. Harvesting wheat.
4. Milling of wheat.
5. Kinds of wheat.
6. Wheat area of the United States.
7. Wheat regions of the world.
8. Importance of the wheat industry.

### II

1. On a map of the world, stick kernels of wheat on the countries noted for its production. Write on each country the name of the month in which its wheat is harvested.
2. Trace route from Odessa to London.
3. Trace route from Buenos Aires to London.
4. Trace route from New York to Buenos Aires.
5. Trace route from Asia Minor to some port in Germany.
6. Trace route from some port in Germany to Brazil.
7. What will form the cargo in each of these journeys?
8. On an outline map, trace a journey from the home town to Dakota. Write the names of the railroads used, bodies of water sailed on, states passed through, and important cities on the way.
9. On an outline map of the United States, color the wheat area and locate all cities mentioned in the chapter.
10. From the station agent in your town, from railway guides, and from maps in your books find the names of railroads entering Minneapolis.
11. Make a collection of the labels on flour bags and barrels. Learn the names of the different kinds of flour and the cities where they are manufactured.
12. Debate on the question: Which country of the world possesses the greatest advantages for the production of wheat?
13. Sketch a map of Canada showing the two great railroads.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in the previous chapters.

Dakota
Kansas
California
Ohio
Indiana
Illinois
Missouri
Pennsylvania
Oklahoma
Oregon
Michigan
Maryland
Tennessee
Minnesota
Nebraska
Washington
Wisconsin
Iowa
Manitoba
British Columbia

Turkey
Asia Minor
Russia
Brazil
Argentina
South Africa
India
France
Austria-Hungary
Germany
The pampas
Duluth
Buffalo
Minneapolis
St. Paul
Chicago
St. Louis
Montreal
Quebec
Port Simpson

Odessa
London
Liverpool
Hamburg
Buenos Aires
James Bay
Peace River
Red River
Black Sea
Strait of Bosphorus
Sea of Marmora
Strait of Dardanelles
Mediterranean Sea
Strait of Gibraltar
La Plata River
Paraná River
Uruguay River
Atlantic Ocean
English Channel
Dover Strait

# CHAPTER X

## CORN

If we were to ask different people to name the most valuable product of our country, no doubt the answers would vary widely. Some, thinking of the bread of the nation, would answer wheat; others, with the clothing material in mind, would say cotton; while still others, thinking of our mineral wealth, would mention gold, silver, coal, or iron. But all would be wrong, for our corn crop exceeds in value any one of these, or, in fact, several of them put together. It is worth more than both our wheat and cotton crops, and seven or eight times as much as our gold and silver. If to the value of the annual gold and silver output we add that of coal and iron, even then the total value is not so great as that of the corn. This seems hard to believe, but Uncle Sam's figures are not to be contradicted. The value of the annual corn crop is more than one and one-half billion dollars. About ninety million people live in the United States; so, if this money could be divided equally, each one would receive each year nearly seventeen dollars.

Perhaps we can better appreciate the amount of corn raised in this country if we think of it in another way. The annual product of the United States is more than three billion bushels. An immense quantity, is it not? It certainly will seem so when we try to put all of it into bushel boxes. Let us set them side by side and begin to fill them from our pile of corn. We fill one row of boxes long enough

to extend entirely around the world, but the great mountain of corn still seems as large as ever. Ten rows of boxes completely encircling the world are filled with the golden grain, but three fourths of our pile is yet untouched. To use it all in this way, we should need nearly forty rows of boxes side by side encircling the earth. No wonder Uncle Sam is proud of his corn crop, for although this cereal is raised in many other countries, by far the larger part of the world's crop is grown in the United States. And, what is equally wonderful, we use nearly all of it right here in our own country. Let us see where all this immense crop comes from.

If we wish to visit the great corn belt, we must leave the hills of New England, the forest-covered lands of the North, and the fragrant fields of the South, though to be sure corn is raised to some extent in all these places. We will go, however, to the fertile prairies and level plains of the Mississippi Valley where millions of acres of rich soil are covered with the long, waving leaves and yellow tassels of the corn forests. We may well call them forests, for they are much taller than you are, and in the great fields you might walk for hours without getting from under the tall, rustling blades which seem to whisper together over your heads.

Such great fields can be seen in Illinois, Iowa, Nebraska, Missouri, Kansas, Ohio, Indiana, and Texas. In other states also corn is raised, but the eight mentioned produce the greater part of the twenty-five hundred million bushels which we raise every year. Illinois alone produces nearly one sixth of it all, and Iowa nearly as much.

Other industries of which we have read have taken us into the same section of our country, the wonderful Mississippi Valley. Here we find the cotton plantations and

the great wheat and stock farms. Many other products of lesser importance are raised, such as fruit, tobacco, rye, oats, and barley. The level country, the rich soil, the favorable climate, the inland waterways, the great railroads, all combine to make this valley the most productive of its size in the world.

Suppose we select a corn farm in Illinois and see how the great crops are raised. We might visit many which

FIG. 47. AN ILLINOIS CORNFIELD
United States Department of Agriculture

cover several thousand acres, but you will be more interested in one which is carried on by a boy of only fourteen years of age.

John's father owns a farm of more than twenty thousand acres, a large part of which is devoted to the raising of corn. John has helped his father so much that he understands as well or better than many a man how to do the necessary work. He was very much pleased when his father gave him ten acres of good land and the corn with which to plant it. The first year his crop averaged thirty

bushels to the acre, nearly the same as his father's. He sold his three hundred bushels for forty cents a bushel, which was a fairly good price, and realized from the sale one hundred twenty dollars.

One day at school, John's teacher took the class to hear a lecture by a man from the State Agricultural College, on the importance of using good seed corn. He told them how easily the yield of the land might be doubled if farmers would only select with more care the seed which they planted.

The boys, most of whom were sons of corn planters, were much interested in the lecturer's description of experiments carried on at the college and on certain farms in the state. In these places, great care was exercised in selecting the ears of corn that were to be used for seed. The fine, large ears were carefully saved, and the next year a row was planted with the very best kernels from these ears. It was found that the crop produced was much better than that grown from seed not carefully selected. The corn from the experimental row was gathered the second year, and the very best selected for planting the next spring, with better results than before. This had been continued for several years until the crop had been increased from twenty-five bushels to fifty, seventy-five, and, in some cases, even to one hundred bushels per acre.

The lecturer went on to tell of prizes that were offered in the state for the best crop produced on a boy's farm. There was great excitement in the school, for most of the boys, like John, had some of their fathers' land to till.

The next year many of the boys bought some of this improved seed corn for at least a part of the land they were

cultivating, and found that the lecturer had spoken truly when he said it would increase the yield. The following year John planted his ten acres with seed which he had carefully selected from the very best of the last year's crop. He tended it carefully and cultivated it often, and in September, when the judges awarded the prizes, John received the one for that district. His crop averaged seventy-five bushels per acre, more than double the yield of many of the farms around.

The enthusiasm of the boys and the excellent crops obtained proved a stimulus to the older farmers, and this is

FIG. 48. CORN FROM GOOD AND FROM POOR SEED

one of the many ways in which our yield of corn has been greatly increased. The state agricultural colleges, the United States Department of Agriculture, the corn breeders' associations which have been formed in many states, are all helping in this great work. You can see how important it is when I tell you that there are one hundred million acres in the United States devoted to corn culture. If the yield is increased only five bushels per acre, that would mean five hundred million more bushels in the whole country. This, at forty cents a bushel, would amount to two hundred million dollars. All this can be brought about

without increasing the cost of raising corn or the amount of land devoted to it. No wonder the Western farmers are beginning to appreciate the importance of using good seed, when an increase of only two bushels per acre on a farm of two thousand acres means a thousand or two more dollars in the farmer's pocket.

Wonderful things have been accomplished in many of the agricultural experiment stations in the United States. Corn with wide blades and corn with narrow blades, corn of great height or corn of small stature, has been produced simply by careful selection of seed. The ears have been made to grow higher on the plant or nearer the ground. The kernels have been made to increase their food values or their starchy elements according as the crop is to be used for cattle food or cornstarch. The quantity of oil or sirup which the corn contains has been made to vary. All this work has required much study and experiment, extending over many years.

These Western farmers cannot gather their crops by hand. Wonderful machines have been invented to do this work for them. One such machine cuts the stalks and binds them into bundles. Another breaks the ears off and, what seems more wonderful, tears the husks from them at the rate of thirty bushels per hour. Attached to the machine is a fanlike arrangement which blows the stalks through a tube to the place in the barn where they are to be stored. A steam sheller takes the kernels from the cob at the rate of a bushel a minute. It would take a man between one and two hours to shell the same amount by hand. If the whole population of the United States were set to work, it would take more than three months for the crop to be all shelled.

After shelling, the corn is either sent directly to the mill, if it is to be ground into meal, or stored in elevators to await shipment. Hundreds and hundreds of freight trains are busy carrying it to the great centers, and although most of the important railroads which enter or cross the Mississippi Valley have thousands of cars in which the grain may be carried, each year there is a demand for more.

FIG. 49. CUTTING CORN BY MACHINERY

We have talked so long about the quantity of corn which we raise, and the care of it, that I am sure you are wondering what can be done with it all, for very little of it is shipped to other countries. The first and greatest use is as a food for animals. The hog farms of the country, on which sixty million hogs are raised, are situated principally in or near the corn belt, where the animals may be fattened for market upon the grain raised near at hand. The cattle

raised in the West are fed on corn for some months previous to slaughtering, so you see that much of our corn and meal is shipped abroad in the form of beef and pork. This is one of the reasons why so many of the great packing houses of the country are located in or near the corn belt.

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FIG. 50. HOGS IN KANSAS

Here is a good illustration of the fact that no industry can exist independently, but that each one depends on others. If our corn lands did not exist, it would not be profitable for many of the hog and cattle farms to be carried on where they are at present. If these were removed, some of the great packing houses would have to go out of business. Remove the corn lands, some of the dependent

live stock, and the slaughtering firms, and many railroads would find their freight decreased so much that it would not pay to run to some towns which they now enter.

People as well as animals like food made from corn and corn meal, for it is nourishing and agreeable to the taste. In the South, "hoe cake" and hominy are common dishes; and in the North, corn cake, or "Johnny cake," mush, and hulled corn are well-known articles of diet. Some of the breakfast foods so popular at the present time are made from this cereal. The kernels of corn contain much starch, and cornstarch is an important product of this useful grain; there are great factories for its manufacture in New York and surrounding states. Glucose is a sirup made from corn and serves as a substitute for sugar, though it possesses less sweetening power. It is the chief ingredient in cheap candies and is used in large quantities in preserving, as it is said to keep the fruit in good form and color. It is used also in large quantities for mixing with molasses and other sirups.

The stalks and leaves of corn, if green and tender, make good food for cattle and are much used for fodder. They are sweet and juicy, and come at a time when the grass in the pasture is apt to be dry. Great fields of corn are planted for this purpose, particularly in the dairy regions, and are fed to cattle during the summer. Sometimes the stalks are cut when green, and are put into tall, air-tight bins called silos, where they are kept until winter and then fed to cows.

But beside its value as a food product, corn has other uses which may not be so familiar to you. The dry cobs are used for fuel in the corn-raising regions. Three tons of cobs are said to be equal, for heating purposes, to one ton of coal. Large quantities of corn are used in the manufacture of

whisky, alcohol, and other spirits, and distilleries are found in Louisville, Peoria, and other cities in the corn belt. An oil is made from the grain which is used in diluting olive oil, in the manufacture of soaps, as a lubricator, and for other purposes. The corn stalks are sometimes used for thatching roofs. Stalks, leaves, husks, and pith are being used more and more in the manufacture of paper. Most paper to-day is made from wood pulp, and, as the forests are fast disappearing, many people are wondering what will be the future source of supply for paper manufacture. Some people think our cornfields will supply it. The husks are used for mats and mattresses. The pith has a peculiar use. It is compressed into sheets and is put between the steel plates of battleships. If a small quantity of this compressed pith is put into a glass and water added, the pith will swell very quickly and fill the glass. So, if a cannon ball pierces the side of a battleship which is covered with this material, the moment the water touches it, it will swell sufficiently to fill the hole.

It seems that with corn, as with other products of which we have spoken, there is no waste portion, but every part — cob, kernels, husks, leaves, pith, and stalk — finds a use.

So far we have been speaking chiefly of one kind of corn, Indian corn, or maize, as it is called in this country. The Europeans had never seen it until they found it growing in the fields of the Indians. Although it was one of the chief articles of food to the red man, all their cornfields put together would not produce what is raised to-day in one county of Illinois. We do not know certainly just where corn was first grown, but we do know that Columbus carried some of the strange food back to Spain, where it

was afterwards raised, and from there it spread through the countries of Europe and Asia. To-day it is cultivated to some extent in nearly every country of the world where the climate is not too cold, but nowhere in such large quantities as in the United States. Austria-Hungary is the next greatest producer, and Mexico and India depend on it to a considerable extent for a food product.

Indian corn has some near relatives which you probably like better to eat. You are all familiar with pop corn and know its use. Sweet corn is one of our appetizing summer foods, and quantities of it are canned so that we can enjoy it in the winter season also. Did you ever think what an immense number of cans must be filled each year to supply the demand?

Most of the sweet corn is grown in New England, particularly in Maine. The valley of the Kennebec River is a very productive area, and many of the large canneries are in this region. Sweet corn is planted and tended much as Indian corn is, and, when it is nearly ripe, inspectors are sent by the canners into the fields to tell the farmers when to gather the ears, so that they will be at their best. After the crop is gathered and sent to the canneries, it is husked by hand, and, for the few weeks that the industry lasts, whole families find employment in husking the corn or in some other part of the work. The corn is shelled by machinery and then partially cooked. The cans are then filled and the cooking completed. The sealing, labeling, and shipping keep many hands busy until the last of September, when the canning is finished for the year.

Maine has more than fifty canneries, some of which prepare daily from fifty to seventy thousand cans, though most

of them are much smaller. From five hundred thousand to a million cases (the number depending on the crop of corn) are often sent out of the state in one year. Much of this is shipped from Portland, which is the center of the industry.

There are other members of the corn family which have important and interesting uses. As you sweep the floors of your house, did you ever wonder where the stiff straws, of which your broom is made, come from? They are obtained from a cousin of the Indian corn, which, from the use to which the tassels are put, is called broom corn. This variety is raised in some of the states of the corn belt, chiefly in Illinois, which produces one half of the crop. It is raised also to some extent in Kansas, Ohio, and Missouri. Its cultivation is similar to that of Indian corn, but farmers find more difficulty in producing a successful crop. One ton will yield brush enough to make one hundred dozen brooms.

Another relative of the maize is the Kafir corn, now cultivated in many parts of the West. It takes its name from the Kafirs, a native tribe of South Africa, who have raised this corn for many years. It furnishes a good food for cattle and is being introduced into the United States, as it will grow successfully in places where, because of the lack of rain, other varieties cannot be raised. The crops of Kansas and Oklahoma have been much increased since the introduction of Kafir corn.

The corn family has still other members. Sorghum, from which molasses is made, and the common sugar cane of the South also belong to this family, and all these bear a much stronger resemblance to one another than relatives in the human family often do.

## Topics for Study

I

1. Value and importance of the corn product.
2. Corn area of the United States.
3. Trip from the home town to a farm in the corn belt.
4. An Illinois boy's farm.
5. Breeding new corn.
6. Uses of corn.
7. History of corn.
8. Corn in other countries.
9. The corn family.

II

1. Review Chapter IV and explain why such great corn crops can be grown in the Mississippi Valley.

2. Make a list of the waterways of the Mississippi Valley; also of all the railroads you know that enter it.

3. On a map of the United States, color the corn belt and write the names of the states included.

4. Find the large cities in this belt to which you think corn is sent for distribution. Find some of the railroads which carry it; some of the rivers.

5. Name some parts of the corn which were formerly waste products. Of what use is each?

6. How does the United States government aid in the corn industry? In what other industries have you read of help given to the people by the government?

7. How has the size and surface of the United States influenced the kind of machinery used?

III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in previous chapters.

| | | |
|---|---|---|
| Illinois | Texas | Great Lake route |
| Iowa | New York | Chicago |
| Kansas | Oklahoma | St. Louis |
| Nebraska | New England | Louisville |
| Missouri | Mexico | Kansas City |
| Ohio | India | Peoria |
| Indiana | Kennebec River | Portland |

## CHAPTER XI

### COAL

What should we do without coal, that hard, black rock which warms our houses, runs our locomotives, and which yields us many useful products, gas for lighting and heating, dyes, medicines, and oils? The industrial world of the present could not exist without coal, yet before its discovery people managed to live comfortably, though they could not carry on the commerce, the manufacturing, or the many other industries which make our world to-day very different from that in which our great-grandfathers and great-grandmothers lived.

A story is told of a hunter who went to sleep one night by his camp fire, only to be awakened later because he was so warm. To his astonishment he discovered that the heat came, not from the wood he had gathered the night before, for that had entirely burned out, but from the black rock in the earth, which had taken fire. And this hard rock, the burning of which seemed so wonderful to him, is the common coal with which we are so familiar. This story, if it is true, is a striking illustration of the fact that many of our most useful products have been discovered by accident.

A visit to a deep coal mine is wonderfully interesting, for the life and surroundings there are so different from those to which we are accustomed that it seems as if we were in another world. There are many states to which we might go for a visit, but we will choose Pennsylvania, for that

state mines more coal than any other in the United States. Rich fields of soft, or bituminous, coal are found in the western part, while in the eastern section is the most important hard-coal area of the world.

Wilkesbarre is a typical mining city, and deep in the earth

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FIG. 51. MINERS' WIVES SEARCHING FOR COAL ON CULM PILE

under it we shall find the mine which we are to explore. As we approach the city by train, the cars become more and more dusty, and when we finally alight, we find ourselves covered with coal dust, so that collars and cuffs, faces and hands, are anything but clean.

The first sights which impress us in a drive about the city are the great hills of broken stone. These are "culm heaps," the accumulation of slate and other refuse which is picked out of the coal after it is taken from the mines. Little use has been found for the culm, and the huge piles



FIG. 52. MINERS' CHILDREN AND HOUSES IN PENNSYLVANIA

are accumulating so rapidly that the disposal of them is becoming a serious question. Poor, ragged women and children are often seen on them picking up stray pieces of coal, or bending under the weight of heavy pailfuls which they are carrying to their homes.

As we drive by one large field, we notice a valley, or depression, in the middle of it, different from anything we have ever seen. The driver informs us that a mine underneath once caved in, and the ground has sunk into this curious shape. It seems strange to think that there are mines under the ground on which we are riding, and stranger still that the whole city of Wilkesbarre is undermined to within one block of the central square, and that many hundreds of people and animals are living and working beneath the ground.

But we must hasten to the mine which we have come to visit. First, however, we must obtain permission to descend, a privilege not always, and in some mines never, granted to visitors. Then we must put on our oldest clothes and a cap which will cover our hair, for a coal mine is not the cleanest place in the world. Just before starting, the "boss" who is to accompany us gives us some long-handled tin lamps to carry, and we make our way toward the shaft, or opening in the ground, which leads down to the levels where the coal is obtained. There are four divisions in this great opening, two for the elevators which hoist and lower the coal and the workmen, one for ventilating the mine, and the fourth for pumping out the water which constantly accumulates underground. The shaft in this particular mine is about eight hundred feet in depth, a little less than a sixth of a mile. Some mines are much deeper than this. In some countries the coal miners go nearly a mile below the surface of the earth for their day's work.

The elevator which takes us down into the mine is much like a common freight elevator, consisting of a floor with a rail along two sides, to which we cling as we think of the

dark journey we are to take. Strong cables from each corner join into one very large one, and we are somewhat reassured when we are told that no miner is allowed to descend

Fig. 53. Miners starting to go down the Shaft

into the mine in the morning until after this cable has been carefully inspected.

The drop of eight hundred feet is not so fearful as we had imagined; indeed it is over so quickly that we have

little time to be frightened. But what a strange world greets our eyes as we step from the elevator at the foot of the shaft! A long gangway, with walls and floor and ceiling all of shining black coal, stretches out into the darkness. This gangway is from ten to fourteen feet wide and perhaps ten feet high, and for some distance from the shaft is lighted by electricity. The first thing our conductor does as we step from the elevator is to telephone to the engineer at the surface. Yes, telephones and electric lights are in many of the modern mines, and in some the cars which bring the coal to the shaft are run by electricity also. Those in the mine we are visiting are drawn by mules. There are eighty sleek, fat, well-kept mules, some of which have never been up to the surface of the earth since they were first taken down nine years before. Their stables are neat and clean, and their feed troughs are supplied with running water. They are given a good breakfast and supper, but are not taken from their work for dinner. The animals are intelligent and soon know without a command when to start with their loads, and when and where to stop.

Our guide tells us that there are twenty-two miles of railroad track in this mine, which covers an area of three quarters of a square mile; and although we spend the whole forenoon in visiting different portions, we really see only a very small part of it.

Finally our guide is ready, and we start out to see the miners actually at work. We travel beyond the electric lights and must light our lamps. They burn with bright flames which flare and blow to and fro in the currents of air which strike them now and then. We see, coming toward us out of the deep blackness, some waving lights,

which remind us of wandering will-o'-the-wisps, but as they come nearer we see that they are only the lamps burning in the caps of a group of workmen. This mine is considered very safe, as it is free from the gases which sometimes cause the terrible explosions of which we will speak later. So here we do not have to carry the safety lamp in which the flame is inclosed by wire gauze.

Presently we see that there are openings leading off from either side of the main gallery in which we are walking. These are called "pockets," or chambers, and in each of them a miner with his two laborers is at work. These pockets are of different lengths and, as they are worked farther and farther, will become galleries connecting with other gangways parallel with the main one. So you see that the mine is a network of passages in which one might easily get lost; but the miners find their way as readily as we do upon the streets of the busy city overhead.

A man is not allowed to mine anthracite coal until he has passed an examination, in which he must prove himself to be of some intelligence and acquainted with the use of explosives, which are much used in hard-coal mining. If his examination proves satisfactory, he is given a certificate and becomes a "certified miner." He usually receives about five dollars a day, out of which he must provide his own tools and explosives and pay his own laborers. Each of these workmen receives from ninety cents to a dollar and a quarter per day, so you see that the amount left for the miner himself is not great. While our guide is giving us this information, we hear a shout and see two flashing lights coming rapidly toward us out of the darkness. We are inclined to run but are assured that we are safe where we are.

The lights, which are in the caps of two miners, approach no nearer. Soon a dull, heavy roar is heard, and the two men start back to their work. Our guide tells us that the noise was caused by the miner in the nearest pocket blasting to loosen the coal. When we reach the place we see a huge mass which has fallen, and find the miner using his pickax and hammer to break off more of the loosened pieces from the wall. While we are looking, he finishes his work and starts for home, though it is not yet noontime. A miner is able to mine in a few hours all that his two laborers can break up, load, and get to the shaft in the whole day, so that by noontime most of the certified miners have left the mine.

As we wander on through the dark galleries, we are astonished at the quantity of lumber used to support the walls and roof. In some places they are entirely sheathed over with plank upheld by strong joists, so that no black, rocky wall can be seen. Every little while we come to large doors which bar our way, and in many cases boys who are sitting beside them open them for us. What a monotonous life this must be, to sit alone in the dark all day long, and open these doors for the mules and cars to pass through! The doors help in the ventilation of the mine, for they direct currents of fresh air into passages where otherwise the miners would not be able to work. The machinery which pumps out the foul air, and thus allows the fresh air to rush in, is the most important of all that is used in mines, for without fresh air no miner could live long in these underground passages. The air seems to us pure and not disagreeable, as we had expected to find it. Our guide tells us that the workmen are usually healthy, and are long-lived unless cut off by some accident.

All coal is not mined in the way we have described, for in some cases the seams are so near the surface that a deep shaft is not necessary. As shown in the pictures, a tunnel is dug into the hillside where the outcropping of the coal has been discovered, tracks are laid in this passageway, and the coal is brought out on cars run by a stationary engine

FIG. 54. SLOPE MINING
Bringing coal to the surface

or drawn by mules. As this mining is carried farther and farther into the earth, a shaft becomes necessary to reach the lower levels. This stripping of the coal from where it lies near the surface is called drift- or slope-mining or tunneling, and often precedes mining by a shaft.

As we look at the glistening walls around us, we wonder what this black rock really is, and why it will burn so

steadily and with such heat when other rocks put our fires out. It is an interesting story, one of the chapters in Nature's book, which, to those who can read it, reveals most wonderful secrets. In the story of coal, Mother Nature bids us go back in the history of the world many, many



FIG. 55. MINERS GOING INTO SLOPE

years, to a time when the climate was much warmer than at present and when there was no frigid zone. There was no man as yet upon the earth. Perhaps he could not have lived here then because of the gases with which, some geologists tell us, the air was filled. But carbonic acid gas,

of which there was probably much in the atmosphere, is just the food that plants like best, so they grew to immense size. These were curious plants which grew in the Carboniferous age. We should think them very queer indeed. We should miss the flowers which make our earth so beautiful, for there were none then, except a few so small and dull and so much like leaves and buds that they would have been hard to find.

Imagine ferns, somewhat like those which wave in our swamps, grown to huge trees, or the little club moss as large as our big oaks and elms, and you will have some idea of the wonderful vegetation of that far-away time. There were thick forests of these giant ferns and mosses mingled with hundreds of other trees. These had all grown to a great size and to a good old age; some had fallen and decayed, and others had taken their places, when Nature began her work of mountain-building.

As the earth cooled, the crust or surface contracted and wrinkled, much as the skin of a baked apple does when taken from the oven. The crust sank in some places and was pushed up in others. These sunken regions were covered by water which flowed in over them, and in these places, as the years went on, were spread out great quantities of soil which had been worn from the upraised portions of land.

As the movements of the crust continued through the centuries, these submerged regions were raised above the waters, and another forest grew and flourished above the sunken one. This in turn was submerged and covered with silt, and from heat and pressure both vegetation and soil gradually hardened into rock. This happened many times, and

the buried forests gradually became changed into the hard, black substance we know as coal. The lower layers, you can see, would be harder and less like wood than those buried later, because the heat and the pressure were much greater as the distance from the surface increased.

This hardest variety, which burns with no smoke and gives a great heat, is what is known as anthracite coal. The softer kind is called bituminous and is found in much greater quantities than the anthracite. Then there is a kind formed under less heat and pressure, in which wood, leaves, and twigs can be seen partially changed into coal; this is called lignite. And last of all is the peat, which you can find for yourselves to-day in swamps. For a long time the grasses and leaves and plants have grown and died and decayed, so that if you were to dig down for some distance you would find the soil made of this vegetable matter called peat. Now suppose the swamps should sink, or for some reason be covered with water. For many years the rivers and brooks would carry down and spread their loads of silt over the bottom of the pond or lake formed in the depression, and the peat would in time harden into coal something like that which is mined to-day. Peat is found in large quantities in the bogs and swamps of Ireland, and is used to a great extent for fuel by the people of that country. It is also found in considerable quantity in the United States. Perhaps when our forests have vanished under the hand of the lumberman, and our coal beds are exhausted, peat may come into greater use with us as a fuel.

The softer coal burns much more easily than the anthracite. Curious stories are told of the difficulty which the discoverers of hard coal had in persuading people to use it.

When they could not make it burn in their stoves, they were sure they had been cheated, and that a black rock had been sold them instead of coal.

If the coal "seams," as they are called, had remained where they were formed, you can readily see that they would be so deep in the earth that we might never have known anything about them. But the movements of the earth's crust which are continually going on have lifted and folded and bent these layers, until they are far above the places where they were changed into coal. The rivers and brooks, and the frosts and snows have all helped in wearing away the land, and in many places have lowered it enough so that the coal layers are near the surface, and sometimes even crop out.

You know how disagreeable and unhealthful it is to have any decaying vegetable matter around our houses, because of the gases which are given off. The wind scatters these gases and brings us purer air to breathe. Now as the woody matter, which forms the coal, decayed, it was covered with soil and water. This prevented the gases escaping, and it is because of their presence that coal burns so readily. But it is the gases also which make the miner's life such a dangerous one. The two that are most dreaded are called fire damp and choke damp. Fire damp is a gas that explodes with great violence when fire comes in contact with it. Sometimes the force of the explosion is sufficient to dislodge great masses of rock and coal, which block up the passages so that the miners cannot make their way back to the shaft. Even though the imprisoned miners are unhurt, it is necessary to rescue them quickly, for, following the explosion of fire damp comes the more fearful choke damp, which quickly

suffocates them. The terrible accident in a French mine, in 1906, in which more than a thousand miners lost their lives, was caused by an explosion of gas. In mines where these

FIG. 56. ONE MILE UNDERGROUND IN PENNSYLVANIA

gases are known to exist in great quantity, many precautions are taken for the miners' safety. Lamps with open flames are not allowed; the kind known as the safety lamp is the only one used. This lamp was invented by

Sir Humphry Davy, and is called the Davy lamp. In it the flame is inclosed by wire gauze so that it cannot come in contact with the gas.

In most mines a fire boss is employed whose duty it is, every morning before the first workmen go down, to inspect those parts of the mine which the miners will enter. But in spite of all these precautions, accidents happen, and we often read in the daily papers of some awful mine disaster caused by the explosion of gas or dust. There are other dangers which a miner has to face besides the presence of gases. A great quantity of water enters the mine and has to be pumped out. Sometimes more water than coal is taken out of a mine. Where do you suppose so much comes from? The blast of a miner may loosen the rock which incloses some underground stream, and the water will pour in so suddenly as to flood the passage before the men can escape. Abandoned mines will usually fill with water, and, if another mine is worked too near a flooded one, the walls sometimes break under the pressure, and the water pours through. Miners are sometimes careless in their use of explosives, and supports are torn away by the force of the shock. In these ways many lives are lost.

One of the greatest dangers to the workmen is the caving in of the mine. This may come from several causes, some of which have been mentioned. "Robbing the mine" is the chief cause of its caving in. The amount of coal which has to be left in a mine as a support for the weight of earth above is much greater than that taken out. In the first mining the workmen do not take out much coal, only enough to open and connect the passages, leaving large quantities untouched. The second mining is a little more dangerous,

as the mine is worked again for more of the supporting coal, and the partitions and pillars are made smaller. Sometimes the mine is worked a third time and even more coal is taken from the sides and walls of the passages. This is "robbing the mine." Such mining, indeed, robs it of its safety, for the weight of earth above is often too great for the reduced pillars to support, even though they are

FIG. 57. SETTING PROPS

strengthened by huge timbers. Caving in often follows mine robbing.

The life of a miner is attended by so many dangers that laws for his protection have been passed in the different states where mining is carried on. In Pennsylvania there is a law which requires two hundred cubic feet of fresh air per minute for every man in the mines. One way of securing this is by immense fan wheels with great blades something

like those of a windmill, which revolve at tremendous speed. These wheels are built at the mouths of the air shafts to pump out the foul air, and the pure air rushes in through the other openings. The law provides also that the doors which direct the currents of air in the passages must be tended by keepers.

In each mine there is a room bricked off, warmed, and provided with medicines, blankets, and bandages, so that injured workmen may not have to wait to be taken above-ground before anything can be done for their relief. The superintendent of the mine and some of the bosses receive instructions from a physician as to the proper treatment in case of sickness or injury.

Another law provides that no coal breaker nor any other building, except such as are absolutely necessary to hoist the coal, to provide air, and to pump out the water, shall be erected over the shaft. Before this law was made, some serious accidents occurred from fires, when the falling timber and machinery blocked up the shaft, so that the men were imprisoned in the mine. These are only a few of the many laws which have been made to protect the miners in their dangerous underground life.

There is much to be done to the anthracite coal after it is taken from the ground, before it is ready to burn in our stoves. It comes from the mine in huge lumps, some as large as, or larger than, a bushel basket, and it must be broken up into suitable sizes before it can be used. This is done in a coal breaker. On arriving at the breaker the coal is taken on an endless-chain arrangement to the highest part of the building, whence it falls from floor to floor, until it finally drops into the cars waiting to receive it.

As the coal reaches the top of the breaker, it falls upon an inclined moving floor, on either side of which men stand with pickaxes or huge hammers and break up the largest pieces. It then passes upon great screens, which shake continually back and forth, making a deafening noise and



FIG. 58. LARGEST COAL BREAKERS IN THE UNITED STATES

shaking the smaller pieces into screens below. These great screens are inclined, and the shaking moves the coal which is too large to go through the meshes to the lower edges, where it falls to other screens with coarser meshes. This process goes on until the coal is sorted into various sizes.

These have different names by which buyers can order. Some of the more common kinds are broken coal, egg, stove, chestnut, and a still finer variety called pea coal.

After the coal is thus sorted there is much slate and other rock fragments mixed with it, and these must be picked out by hand. No machine has yet been made which will successfully separate the slate from the coal, though men are constantly working to invent one. Every breaker has a large room, or several rooms, filled with wooden shutes lined with sheet iron, down which the coal slides in endless streams from the screen rooms. Boys are stationed at intervals along the shutes to pick the slate from the coal. The "green" hands are near the top and the more experienced workmen below, and by the time the coal reaches the last boy, little slate is left in it. All day long the boys sit at their work beside the continuous stream of coal, but no matter how fast their fingers may fly, they can never succeed in emptying the trough before them. It is a hard, miserable life. You know how much noise a little coal can make when it is shoveled into your cellar. Think how noisy this room must be where there are many, many shutes all filled with the moving coal. There can be no talking even if the boys could spare time for it. On account of the dust, the coal has been wet in the screens above, and in winter the handling of this cold, wet rock chaps the boy's hands so that they often bleed, and the finger nails are worn down to the quick. It is no wonder that the great ambition of all breaker boys is to get a position as door-keeper or mule driver in the mine. That seems a hard life to us, but it is much to be preferred to the work in the breaker.

The coal, after being cleaned by the breaker boys, falls into cars waiting to receive it, and is run out to tracks, whence it may be moved to the great shipping ports. The slate which has been picked out accumulates in the hills of culm which are familiar sights in all anthracite coal regions. You can imagine how large these piles must be and how fast they grow, for about one sixth of all the coal taken from the mines is waste material.

Before the coal leaves the grounds, it is tested by government officials, and if too much slate is found in it, it is sent back to the breaker to be recleaned. These noisy, dusty coal breakers are found only in the anthracite region, for this is the only kind of coal which needs to go through the process.

Coal is mined in twenty-eight of our states and territories, and it exists also in many places where the deposits are not thick enough to pay to work. The seams may vary in thickness all the way from a few inches to fifty or sixty feet, although the latter are rare. In the United States where the mineral is abundant, little is mined where the layers are less than three feet thick, but this is not usually true of other countries.

It seems queer that, considering the great coal area in the United States, the anthracite deposits should occupy a region not half so large as the little state of Delaware. Yet comparatively small as this area is, it is the largest, richest field of anthracite coal found anywhere in the world. There are three great regions of bituminous coal in the United States, making a combined area nearly as large as Texas. The eastern field is found along the Appalachian Mountains, from Pennsylvania to Alabama. The central section

includes parts of Indiana and Kentucky and nearly two thirds of Illinois.

The third region lies farther west, including parts of Iowa, Missouri, and Kansas, and extending into adjacent states. We think of these states as being in a fertile region and yielding rich crops of wheat, corn, hay, and other products, and are apt to forget that from beneath the surface, as well as from above, a rich harvest is being reaped. Notice that the great coal areas lie chiefly in the eastern half of the country, while the so-called precious metals, gold and silver, lie in the great western highland.

Of the three coal areas which we have located, the eastern one is the most important; for of all the three hundred million tons of coal which we mine in one year, Pennsylvania produces nearly one half, and more than one third of all her output comes from her rich anthracite fields. But what an enormous amount! Three hundred million tons of coal every year! This is more than one third of the whole world's supply. If this were all piled into a great mass, we could build a solid wall forty feet high, and wide enough to afford a street and sidewalks along the top, on which we might go from Boston to Denver. If this great pile of coal were put to a different use, it would feed for more than twelve million years a fire in a furnace which consumes eighteen tons a year, and few house furnaces burn as much.

When we read of all the coal which is taken out of the ground each year, we begin to wonder what is done with it. Near the coal regions there are great cities, in which the product is used for manufactures and from which it is shipped. These cities have become large and important mainly because of their location near the mining regions.

There are also many railroads having thousands and thousands of cars which carry only coal; and there are steamboats plying on river and lake and ocean, loaded entirely with this useful black rock.

The Pennsylvania Railroad has a network of tracks extending all through the state of Pennsylvania and penetrating its many coal fields. The Delaware, Lackawanna and

FIG. 59. COAL BARGES ON THE OHIO RIVER
(Courtesy of the Cincinnati Industrial Bureau)

Western, the New York Central, and other railroads are much interested in freighting coal. Some railroads own the mines whose product they carry. One of these railroads has seventy-five thousand cars for carrying coal, with more than a thousand engines to haul them. Hundreds of boats and barges loaded with coal may be seen on the Great Lakes and on the Ohio and adjacent rivers.

From the anthracite region, quantities of coal are sent to New York and Philadelphia, where much is used in the great manufacturing industries, while some is shipped thence to other eastern cities. Very little of our coal is sent abroad. It does not pay to carry it far because it is so bulky, and coal deposits are so widely distributed over the earth that other nations can get theirs near at hand.

The coal mined in western Pennsylvania is used largely in Pittsburg, Buffalo, Cincinnati, and other cities in that vicinity. From the central area, most of the coal goes to Chicago. From the western coal field, St. Louis receives a greater amount than any other city. In what other industries have these cities been mentioned?

Our iron and steel manufactures are greater in amount, less in cost, and finer in quality than those of any other country in the world. One reason for this is because the rich fields of coal and of iron lie near each other. All along the Appalachian Mountains there are vast deposits of iron, and even richer fields have been found around Lake Superior. You can see how easily and cheaply this iron ore can be brought by the Great Lake route to the manufacturing cities in Pennsylvania and vicinity. No wonder that Pennsylvania leads the world in her steel products when the two materials necessary for such manufactures lie so near together or are connected by such a splendid transportation route.

If you will look at the map you will see that coal and iron deposits are found near each other at the southern end of the Appalachian Mountains. The city of Birmingham in Alabama is situated near the center of these southern fields, making it the "Pittsburg of the South," the industrial

center of the country between Atlanta and New Orleans. The city is built in a region where cotton was formerly the chief product, but the riches under the soil have proved greater than those on the surface. Now the cotton plantations have given way to mines, and the trains leaving the city carry more iron and steel than bales of cotton.

But we must not confine our study of coal to our own country, for deposits are widely distributed over the earth. Many of these are being mined, but many others are as yet untouched and will be a source of future wealth to the countries in which they are situated. Such beds are found in the Chinese and Russian empires and in other Eastern countries.

Nearly all the countries of Europe mine coal, chief among them England, Germany, France, and Belgium. The product is chiefly of the bituminous variety, for little anthracite is found in that continent. Until recent years England led the world in the amount mined, but the United States has finally outstripped her. We have many advantages over her which explain our supremacy in the race. England's coal has been mined for centuries, and was one of her chief sources of wealth when nothing was known of the vast deposits in the New World. So her mines are deeper and harder to work than ours. Many of the seams of coal also are much thinner than we think worth working here. London, however, still holds its place as the largest coal market of the world, though New York City and the neighboring New Jersey ports are not far behind.

A story is told of the opposition to coal when first introduced into London furnaces. It was bituminous coal, which, as you know, burns with much smoke. People thought

with their experiments, and, sure enough, by mixing strange compounds with some of the substances left in the coal tar, these wise men finally brought to light beautiful colors — red, purple, blue, green, and many others. Almost a miracle, is it not, that the brilliant coloring matter that made your dress and necktie just the bright, pretty colors you like so much came from the black, dirty coal? These aniline dyes, as they are called, have almost entirely supplanted the vegetable and animal substances which were formerly used, for the mineral dyes are more brilliant and can be produced much more cheaply.

## Topics for Study

### I

1. Trip to a coal mine.
2. Description of mine.
3. Methods of mining.
4. Formation of coal.
5. Dangers of mining.
6. Laws for the protection of miners.
7. The coal breaker.
8. Coal areas in the United States.
9. Manufacturing and shipping centers.
10. Coal deposits in other countries.
11. Uses of coal.

### II

1. Imagine yourself a "breaker boy" and write a story concerning your life and work.

2. Color a map of the United States to show the three areas of bituminous coal production and the anthracite area. Mark on the map the names of the states included and the principal shipping port from each area. Trace also the length of the pile of coal that might be made from our annual coal production. Indicate by dotted lines the coal-carrying railroads. Where do they carry it? What cities mentioned in the coal industry have been mentioned in other industries?

**3.** Ship a cargo of coal from each of the following cities: Pittsburg, Philadelphia, Chicago, St. Louis, and Birmingham. Tell in each case to what city the cargo will be sent and by what route.

**4.** What canals are used to aid in the transportation of coal? What rivers?

**5.** Great coal-producing countries are as a rule manufacturing centers. Find in your textbook what are the chief manufactures of the countries mentioned in this chapter.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in previous chapters.

| | | |
|---|---|---|
| Middle Atlantic States | Denver | Ohio River |
| Pennsylvania | New York | Detroit River |
| Alabama | Philadelphia | St. Clair River |
| Illinois | Pittsburg | Niagara River |
| Kentucky | Cleveland | Delaware Bay |
| Indiana | Buffalo | Chesapeake Bay |
| Iowa | Chicago | Lake Superior |
| Missouri | St. Louis | Lake Michigan |
| Kansas | Birmingham | Lake Huron |
| Siberia | London | Lake Erie |
| China | Susquehanna River | Lake Ontario |
| England | Allegheny River | Lake St. Clair |
| Germany | Monongahela River | "Soo" Canal |
| France | Delaware River | Strait of Mackinac |
| Belgium | Mississippi River | |
| Boston | Missouri River | |

# CHAPTER XII

## IRON

Iron vessels cross the ocean,
  Iron engines give them motion ;
Iron needles northward veering,
  Iron tillers vessels steering.
Iron pipe our gas delivers,
  Iron bridges span our rivers.
Iron pens are used for writing,
  Iron ink our thoughts inditing.
Iron stoves for cooking victuals,
  Iron ovens, pots, and kettles.
Iron horses draw our loads,
  Iron rails compose our roads.
Iron anchors hold in sands,
  Iron bolts, and rods, and bands.
Iron houses, iron walls,
  Iron cannon, iron balls,
Iron axes, knives, and chains,
  Iron augers, saws, and planes,
Iron globules in our blood,
  Iron particles in food,
Iron lightning rods on spires,
  Iron telegraphic wires,
Iron hammers, nails, and screws,
  Iron everything we use.

Did you ever think that the nations which produce the most coal and iron are the strongest and most civilized? A nation's advance may be measured by its use of iron; it is the metal of civilization,—

For, since the birth of time, throughout all ages and nations,
Has the craft of the smith been held in repute by the people.

Iron is the most widespread of all metals, as well as the most useful. It can be cast into any shape, rolled into sheets, drawn out into fine wire capable of supporting great weights, sharpened into sword blades, and fashioned into plowshares. Frames for buildings, steamships, rails, cars, engines; pipes for water, gas, and oil; medicine to make us strong; nails, locks, hinges, horseshoes, tools of all sorts; machinery for every industry, — all testify to the great variety of uses to which iron can be put.

We should have to go far back in history to find the period when iron was not known. The Egyptians used it as long ago as when the great pyramids were built. In the Bible its use is spoken of in connection with early Hebrew history. Moses speaks of furnaces for melting iron, and we even have given us in these ancient records the name of one of the first workers in iron and brass, — Tubal-Cain.

More than thirty million tons of iron ore are mined in the United States each year, which is worth at the mine about sixty million dollars. After being separated from the impurities with which it is found, this ore yields rather more than half as much pig iron, or about eighteen million tons. It is hard to form an idea of what these figures mean. Perhaps an illustration may serve to make us better able to appreciate this amount. Suppose we construct a sidewalk, two inches thick and six feet wide, out of the iron which is taken from our mines in one year. Such a sidewalk would reach more than halfway around the world. Remember this sidewalk is to be made of the iron which is mined in one year in the United States alone. If it were to be built of all the iron mined annually in the world, it would stretch

nearly three times as far, or completely around the world and nearly one half that great distance again.

Where does all this iron come from? It is widely distributed in our country and is actually mined in more than half of our states. It is found, however, in the greatest quantity in only a few of these. Around Lake Superior in Minnesota and Michigan are the richest deposits in the world, from which we get three fourths of all our vast output. The Appalachian Mountains also contain rich beds in Pennsylvania, West Virginia, Alabama, Tennessee, and other states. There are other places where iron mining is profitable, as in the Adirondack Mountains and in Missouri. In the latter state there are two low mountains, Pilot Knob and Iron Mountain, which are largely composed of rich deposits of this ore.

All of the mines in the Appalachian Mountains and some of those in the lake region, especially in Michigan, are deep mines reached by a shaft through which the iron ore is hoisted in much the same way that coal is taken out. But many of the mines in the Mesabi Range in Minnesota are of a very different kind, and at first glance you would hardly recognize them as mines at all, for there is no hard rock to be blasted, nor are any of the methods practiced which are associated in our minds with mining. No iron was mined in the Mesabi Range before 1892. To-day in this one range alone there are mines enough in operation to produce all the iron and steel manufactured in all Great Britain.

If you were to purchase a mine in this locality, you would buy an area of land very much as you would purchase a farm. The forests, if any, must first be stripped off,

and then perhaps several feet of surface soil. In many places this has already been done by the great prehistoric glacier. When the overlying strata have been removed you will begin to wonder where the iron is, for all that is visible to the eye is loose, reddish-black soil. This is the

FIG. 61. IRON MINES, IRONWOOD, MICHIGAN

iron itself. Here spread out in thick horizontal layers is the ore which is revolutionizing the world's iron and steel industry.

Great steam shovels are at work lifting loads of this loose soil on to cars, for which miles of railroads have been built in these mines. These steam shovels are wonderful machines. One can lift four or five tons at a scoop and

can be operated by only four or five men. So rapidly do the shovels work that a car holding fifty tons can be loaded in five or ten minutes. Five hundred men working hard all day could not accomplish so much as one of these machines. In less than three hours a fifty-car train can be loaded and

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FIG. 62. STEAM SHOVEL AT WORK, BURT MINE, MESABI RANGE

made ready to start to some shipping center. To get this amount of ore from a shaft mine would require two or three days.

From one mine in the Mesabi Range two million tons of ore have been taken in one year. This is as much as the

iron product of the whole country of Sweden. Five mines in the same range are producing more iron every year than is mined in the whole of France, which is the fifth in rank of all the iron-producing countries. In some of the mines the ore has been removed to the depth of from fifty to two

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FIG. 63. OVERLOOKING THE ORE DOCKS, TWO HARBORS, MINNESOTA

hundred feet, and a seemingly inexhaustible supply remains, while new mines are being opened every year.

All iron must first be separated from the other substances with which it is found in the earth before it is ready for manufacture. To do this great heat is necessary, and

consequently much coal is required. The iron is therefore transported from the mines to the coal regions to be smelted. Let us follow it in its journey to the smelting furnaces. Our fifty-car train leaves the mine bound for Duluth, one of the iron-shipping ports at the western end of Lake Superior. We might go either to Superior or to Two Harbors instead, for in each of these places there are immense ore docks, stretching out perhaps a half mile into the lakes; the largest iron-ore docks in the world are situated in these three cities. The train runs out on these docks, and the iron falls from the cars into huge pockets beneath. Only a few minutes are required for the unloading, and the train is soon ready to start back to the mines. In the meantime, on the large boats fastened to the docks shutes are opened, and the ore slides down into the vessels. In less than an hour six thousand tons have been loaded on one vessel, and she is ready to start on her voyage of nearly a week through the Lakes. Between the iron region of Lake Superior and the coal area of the Appalachian Mountains is a great natural waterway, on which the iron can be carried much more cheaply than on land. This chain of lakes contains more than half of all the fresh water on the earth. If the lake coast line which borders on the United States could be stretched out straight, it would reach from New York to San Francisco.

Once out on the Lakes, rightly named "The Great Lakes," there is nothing to indicate that we are not on the wide ocean itself, for part of the time we can see no land on either side. We find indications of the wheat industry in the huge grain elevators near the water in nearly every city at which we stop. We see curiously built boats, called

"whalebacks," laden with wheat and flour. Many others are seen also, with cargoes of iron, lumber, or beef. The eastward moving boats are more heavily laden than those going west, and as we study the different industries, we

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FIG. 64. LOADING A SHIP, TWO HARBORS, MINNESOTA

shall find the reason for this. Cargoes are often taken west at very cheap rates, rather than have the boats return empty.

Perhaps the most interesting part of our journey is through the famous "Soo" Canal, described and illustrated in the chapter on Waterways and Railroads. It is a thrilling

experience to go through one of the wonderful locks in this canal, and to feel our boat gradually sink as the water is lowered until we are nearly on a level with that in Lake Huron.

On this journey we pass many places where we might dispose of our cargo, for all the cities on the southern shores of the Lakes, near the coal fields, are engaged in the iron and steel industry. But our boat glides by Detroit and Toledo, and finally stops at Cleveland. Great machines quickly transfer the iron from the vessel to the cars waiting to carry it to its destination at Pittsburg.

All this lake region has changed and grown very rapidly in the past few years, and comparatively few people realize the immense trade and vast industries which are carried on in this part of the country. Here in the Cleveland district more ships are built than anywhere else in the world, except on the Clyde River in Scotland; more cargo tonnage passes through the Detroit River than through any other river in the world; the machinery for moving ore on these great bodies of water is the best that can be found anywhere; and more ore is moved longer distances and deposited at the receiving ports more cheaply than in any other country.

Until the ore is laid down in Pittsburg at the door of the smelter, you notice that it has been handled entirely by machinery, and it will continue to be so handled until it is turned out in the finished articles of iron and steel. Little handwork is needed. This reduces the cost materially and is one of the reasons why we are able to manufacture fine products of iron and steel more cheaply than any other country.

But while we have been telling of the wonders of the Great Lakes, and of their industries and commerce, our

iron has been unloaded at Pittsburg, and we must now see what becomes of it.

Pittsburg, the Iron City! Pittsburg, the Smoky City! Surely both of these names are appropriate, for as we approach, we see dozens and dozens of tall chimneys pouring forth their clouds of smoke; and iron is everywhere, unloaded at the docks, carried through the streets, and going through all sorts of processes in hundreds of manufactories. The finished products are being shipped away in trains that go in all directions, and in boats that ply on the Great Lakes and on the Ohio River. Pittsburg, the Steel City! More iron and steel are manufactured here than in any other city in the world, and it is for these manufactures that such great quantities of raw material are needed.

Situated at the junction of the Allegheny and Monongahela rivers, and near Lake Erie, Pittsburg's water connections make it possible for the manufacturing supplies to be laid down at her doors quickly and cheaply. By the Monongahela River she has access to the rich coal fields of West Virginia, and the Allegheny River brings her the coal and oil from western Pennsylvania. The Ohio affords entrance to thousands of miles of navigable waters, bordering on twenty states, and finally reaching the ocean itself through the Gulf of Mexico. From the Lake Superior iron mines thousands of tons of ore and pig iron are brought to her very door through the Great Lake route, and it is to aid in this traffic that the canal, of which you read in Chapter V, has been planned.

Great as is the trade of Pittsburg by water, we must not lose sight of the importance of her railway communication. Fourteen railroads enter the city, and by these, goods are

sent east and west and north and south. The commerce in iron and steel in which Pittsburg excels the whole world would not be possible without her railroads.

With all these advantages, is it any wonder that no other city can compare with her in iron and steel manufacturing? Cars, engines, building material, armor plate for ships, cables, wires for telephone and telegraph lines, tools, and machinery of all kinds are manufactured here. The work is so extensive that some of the manufactories run night and day. At one steel plant five tons of material are required for the blast furnaces every minute, and there are hundreds and hundreds of such furnaces in the city.

Blast furnaces are iron structures from forty to one hundred feet high, lined with a material called "fire brick" because it can endure great heat without injury. In these furnaces the iron is melted to separate it from the impurities with which it is always found. This process is called smelting. Into the furnace through a door part way to the top the workmen put, from time to time, coke, ore, and limestone. Coke is used instead of coal because it gives a much hotter fire. The limestone, or some other material which serves equally well, is added because it collects the impurities as they separate from the melting iron. These impurities and the limestone together form an upper layer known as slag, which flows out through a door in the furnace made for that purpose.

During the process of melting the iron, a blast or current of air is forced into the furnace. You know when you open the drafts to your stove how much more brightly the fire burns, and you can imagine what a high temperature is created by a strong current of air, which is sometimes

intensely heated before being forced into the furnace. It is from this method of using blasts that the blast furnace gets its name.

The melted iron, on account of its weight, falls to the bottom of the furnace, and when it is ready, workmen open



FIG. 65. BLAST FURNACES, PITTSBURG, PENNSYLVANIA

a lower door and with long poles push away the iron which has hardened around the opening. With a shower of sparks, like a display of Fourth-of-July fireworks, out pours the molten iron in a stream of liquid fire. Busy workmen by means of poles direct its course into long parallel trenches,

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connected with many shorter ones called pigs. Here the iron cools in round bars two or three feet long and three or four inches in diameter. This is called pig iron and is the foundation of all our iron and steel manufactures. In



FIG. 66. LADLE POURING MOLTEN IRON INTO PIG IRON MOLDS

this form it is shipped to other cities engaged in similar industries.

The smelting is kept up in the large smelting works night and day; the fire in the blast furnace is not allowed to go out until the furnace needs repairing or relining, which sometimes does not happen for months.

In an iron foundry the pig iron is melted again. The purer metal which results from this process is run into molds made of earth, where the iron takes the shape of the article to be made, much as jelly takes the shape of the dish in which it cools. This cast iron, as it is called, is brittle and will break easily. Articles made of it cannot be easily mended. Stoves, machinery, tools, posts, hydrants, and many other things are made in an iron foundry from cast iron.

Wrought iron is a still purer product, softer and easily mended, out of which nails and wire are made. Many things formerly made of wrought iron are now made of steel, which is manufactured to-day much more easily and cheaply than was thought possible a few years ago. The making of steel used to be a slow, difficult process. In its manufacture, air must be admitted in just the right quantity, with the proper force, and for exactly the time that will cause it to drive away the undesirable elements in the iron, for these would injure the quality of the steel. Within a comparatively few years an Englishman invented a method by which this could all be quickly and easily done. The Bessemer process has revolutionized the industry. Work which before this invention would have required days or even weeks to accomplish can now be done in a few minutes.

From what we have said of the immense quantity of iron taken every year from the mines of our country, and the great usefulness of the metal, you know that there must be many cities in the United States where iron manufacturing is carried on. So widespread is this industry that there are few cities of any size which have no manufactory connected

with iron. Pittsburg, of course, ranks first in the list. Then comes Chicago, for it is situated in the soft coal region of Illinois and is connected by water with the famous iron region around Lake Superior. Birmingham, Alabama, ranks third in iron and steel manufactures, for this city lies in the center of the rich coal and iron fields of the South, with limestone deposits near at hand. These are our three greatest iron manufacturing cities, but there are many others in which this industry is of great importance.

The Ohio River is filled with boats and barges carrying thousands and thousands of tons of coal, coke, and iron from Pittsburg to the river ports. These distribute the products to inland cities and also use them in their own manufactories. Thus Cincinnati has come to be the greatest market in the United States for pig iron, and Louisville is an important iron manufacturing city. Both of these cities owe their growth and importance in this direction to their location on the river.

On the Great Lakes, Detroit, Toledo, Cleveland, Erie, and Buffalo are all engaged in iron manufacturing. Cleveland is the second city in size of all the lake ports. As it lies near the iron, coal, and oil deposits of western Pennsylvania and northern Ohio, near the copper fields of Michigan, and in direct water connection with the iron mines of Minnesota and Michigan, we are not surprised to learn that the Cleveland district is the greatest ore market in the world. Its own manufactures of iron and steel are immense, and in the making of wire and nails it holds first rank in our country.

The cities mentioned, together with Baltimore, Wheeling, New York, and others in the vicinity of the coal and iron

areas, manufacture everything one can possibly think of which is made of iron and steel. Philadelphia is near enough to these raw materials to be an important manufacturing city, while its position as an ocean port makes it a commercial center as well. Many vessels sail from here every year carrying the manufactured products of the city as well as those from other cities.

There are two great manufacturing plants in Philadelphia which I am sure you would like to visit. One of these is the Cramp Ship Yard where the finest steel ships are made, not only for use in our own country but in foreign lands as well. The other great manufactory is the Baldwin Locomotive Works, a corporation which makes more locomotives than any other in the world. You could find its engines drawing long trains in Japan, Africa, South America, and in many European countries. More than fifteen thousand men are employed there, and the works run day and night. In one year more than two thousand locomotives are made, an average of more than six each day, besides the repairing of hundreds of others.

After all that we have said concerning the wealth of our iron and coal deposits, and their position with regard to each other, you will not be surprised to learn that our country ranks higher than any others in her iron and steel manufactures. Great Britain comes next, and then Germany, while in Norway and Sweden iron of an excellent quality is found.

Germany is a military country. It has forts and strong defenses. Its army is large and splendidly trained. So it is no surprise to find in that country the largest and most famous gun works in the world. Here are made cannon

and guns, material for ships and railroads, as well as machinery of various kinds. Austria-Hungary, Russia, Italy, and other European countries are furnished with all kinds of defensive supplies from these famous factories. The industry has been carried on by the Krupp family for three generations, and all have shown the same pride in their work, the same honesty, the same thoroughness in detail and finish, and the same interest in their employees.

## Topics for Study

### I

1. Uses of iron.
2. History.
3. Amount mined.
4. Iron areas in the United States.
5. Methods of mining.
6. Trip to a mine in the Great Lakes region.
7. The Mesabi mines.
8. The Great Lakes and their commerce.
9. Pittsburg.
10. Manufacturing of iron and steel.
11. Cities connected with the iron industry.
12. Iron in other countries.

### II

1. Name all manufactures in your home town, or in neighboring towns or cities, connected with the iron industry.
2. Notice the names of firms or of cities on any iron article which you may see.
3. Locate fifteen cities connected with the iron industry.
4. Complete the following sentences:

Pittsburg is the ——.
Two great manufacturing plants in Philadelphia are ——.
Chicago ranks —— in iron and steel manufactures.
Birmingham is the —— city in the South.
Cleveland is the —— of the lake ports.
Germany is a —— country. The —— manufactory is there.

5. Make a list of twenty things which are made of iron.

6. Sketch a map of the Great Lakes, to show the water route from Duluth to Buffalo. Add New York, to show the route via Erie Canal and Hudson River to New York City. Add Massachusetts, to show transportation lines from Albany to Boston. Add Pennsylvania, to show trade routes, both water and rail, between Lake Erie and Pittsburg. Add the Ohio and Mississippi rivers, to show the trade route to the Gulf.

7. Write at least six facts showing the importance of the Great Lakes route.

8. Write at least six facts showing advantages of the location of Pittsburg.

9. Name at least twelve different things manufactured in Pittsburg.

10. Describe methods of mining in the Mesabi mines.

11. Describe the manufacture of pig iron, cast iron, steel.

III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in previous chapters.

| | | |
|---|---|---|
| Appalachian Highlands | Clyde River | Duluth |
| Adirondack Mountains | Ohio River | Two Harbors |
| Pilot Knob | Allegheny River | Philadelphia |
| Iron Mountain | Monongahela River | Superior |
| Mesabi Range | | Detroit |
| | Minnesota | Cleveland |
| | Michigan | Erie |
| Suez Canal | Wisconsin | Buffalo |
| Lake route | West Virginia | Pittsburg |
| | Pennsylvania | Chicago |
| Great Britain | Alabama | Birmingham |
| Norway | Tennessee | Cincinnati |
| Sweden | Missouri | Louisville |
| Germany | Illinois | Baltimore |
| France | Ohio | Wheeling |
| Scotland | Kentucky | New York |

# CHAPTER XIII

## GOLD AND SILVER

### Gold

Gold! Gold! Gold! Gold!
Bright and yellow, hard and cold,
Molten, graven, hammered, and rolled;
Heavy to get and light to hold;
Hoarded, bartered, bought, and sold,
Stolen, borrowed, squandered, doled;
Spurned by the young, but hugged by the old
To the very verge of the churchyard mold;
Gold! Gold! Gold! Gold!

THOMAS HOOD

Probably no gift of the earth has been the source of so much happiness and misery, so great joy and sorrow, as the yellow metal, gold. Because of the power it brings, men have fought and died to obtain it; with this aim in view, no sacrifice has been too great, no hardships too terrible, to endure. The discoveries of gold in California, in Australia, and later in Alaska and Canada have furnished stories of daring, of endurance, of perils, fit to rank with those of Sindbad the Sailor, and "Aladdin or The Wonderful Lamp."

The most thrilling of these tales are connected with the Klondike, for here Nature presented to the daring explorers her most forbidding aspect. The fight was not against heat and thirst, as in the pioneer journeys to California, but against cold, snow, and starvation in this lonely arctic

world, where in the silence, the gloom, the utter isolation, it seemed to the lone prospector that even God was lost.

To-day we can ride at ease in comfortable steamers and railway cars to the very region and over the very trail


FIG. 67. ROUTE TO THE KLONDIKE REGION

which in 1897 and 1898 was the scene of terrible suffering and loss of life. Crossing the country to Seattle, Washington, we can there take a steamer for the Alaskan coast. If we follow the same route which many of the gold hunters took in the first great rush to the Klondike, we shall stop

at Skagway, which is situated upon Dyea Inlet, about twelve hundred miles from Seattle. Here we will take the White Pass and Yukon Railroad, in many respects the most wonderful one in the world. It extends nearer the pole and cost more dollars and more suffering per mile than any other road ever built. Men of almost every walk in life, — college graduates, lawyers, doctors, and other professional men, as well as those who could not write their own names, — were on its pay rolls.

In its construction whole mountain sides were torn away and deep gulches were filled. Much of this work was done when the thermometer was from ten to forty degrees below zero. Disappointed gold seekers of all classes in life found here work with excellent pay; yet if a rumor reached them of a new find of gold, scores would shoulder the company's picks and, with little provision for facing the deadly cold or for satisfying their hunger, depart for the place where the treasures were reported to have been found.

The first few miles of the railroad over the mountains through White Pass, twenty-four hundred feet above the sea, were the most difficult and expensive to construct; some sections cost at the rate of two hundred and fifty thousand dollars per mile. But no railroad ever paid any such interest on the investment during the first few years of its existence as this did. It was the one way over which the necessities of life could be carried to hungry miners, or by which they could get back from the desolate north to friends and civilization. Consequently fares were very high, sometimes as much as twenty cents a mile. Freight charges were in proportion, one hundred dollars a ton not being an exceptional price at the time of the greatest rush.

Continuing our journey, we leave Skagway and follow the old trail over the dreaded White Pass to Lake Bennett. This takes four hours by rail, but for the gold seekers of the nineties, hampered by provisions and mining equipment, it was a four days' journey. On the way to Lake Bennett we pass through Dead Horse Trail, so called because of the hundreds of horses which fell here never to rise again. It

FIG. 68. PROSPECTORS AND THEIR PACKS, CHILKOOT PASS

is said that after the great rush of thousands of prospectors over this trail, it was possible for one to travel for some distance, treading only upon the hides of the horses which had perished. Before the railroad could be built, thousands of the carcasses of these animals had to be removed.

We leave the railroad at White Horse Rapids, where many luckless adventurers lost their goods and often their lives by the swamping of the heavily laden boats, and continue

our way to Dawson by steamer. The whole trip from New York to Dawson can now be made in two weeks, a small fraction of the time that it took the early prospector with his pack on his back, or with his loaded sledge, to make the trip from Skagway.

The word "Klondike" comes from the Eskimo language and is the name of a small Canadian stream which flows

FIG. 69. PACK TRAIN ON THE WAY TO THE KLONDIKE

from the north into the Yukon River about fifty miles east of the Alaskan boundary. Strangely enough, though we hear so much of the discovery of gold in the Klondike, but little has been found in this river itself or on its banks. The creeks and rivers which flow into it, and some of the other branches of the Yukon, are rich in the precious metal. It is found scattered through the sands and gravels, and

the only work necessary is to free the grains of nearly pure gold from the soil in which they are held.

No great companies or syndicates opened up this region by operations on a large scale. The only equipment that a miner needed was a pick, a pan, and a strong back. All of the thousands who rushed to the Klondike in the two years after the discovery of gold began operations in the same way. One or two men prospected, that is, examined the "dirt" where no one had made a claim, until they found some which seemed likely to pay. If two were working together, one man broke the soil and shoveled it into the pan; the other added water and shook the pan with a peculiar twisting motion, until water and gravel were well mixed. The pans were then carefully emptied, and the grains of gold, being heavier, were found at the bottom. After the best claims, where gold was at or near the surface, were taken up, the less favorable ones were worked. Sometimes the gold-bearing gravels were covered for two or three feet or more with moss or clay or other soil, which had to be removed. In the winter this was frozen so hard that fires were lighted upon the ground in order to soften it.

In the richest claims gold worth hundreds of dollars was washed out in this way in a single day. But in most cases it was slow, hard work; and in order to accomplish more, the pan was discarded for the "rocker." This was an oblong-shaped box with a raised screen at one end, on to which the gravel was thrown. The larger stones were held upon the screen, while the finer gravel, with which the gold was mixed, was allowed to drop through. Water was added as in the pan, and the box was moved back and forth, or rocked, as its name indicates, by means of handles. The

Fig. 70. Washing out Gold with Pans

water and gravel were then allowed to flow out, leaving the gold in the bottom of the rocker.

The "Long Tom," and then the sluice, were the next enlargements. These were inclined runways, with cleats called riffles, fastened from side to side across the bottom, to catch the gold. The gravel and water were turned in at the upper end, and the trough was inclined just enough to make the water carry the gravel down and out at the lower end, while the gold was caught in the riffles. Later, because all of it was not saved by this method, the bottom of the sluice was paved with rock or copper to resemble the unevenness of the bottom of a stream. Mercury also was used to some extent, as gold will stick to it, and thus more of the shining metal was saved.

A great excitement prevailed when, soon after the discoveries in the Klondike region, gold was found in the sands at Cape Nome. The easiest route from Dawson to Nome is by way of the Yukon River and thence across Norton Sound. The sail down the Yukon, a distance of nearly two thousand miles, is a trip to be remembered. Few realize that away in this comparatively unknown country flows such a wonderful stream, the fourth largest river in North America. Imagine sailing on one river from Boston to Denver, for the distance in a straight line between these two cities is about equal to the navigable length of the Yukon. The river is free from ice only three months during the year, and at the present time nearly forty steamers sail on its waters during the open season.

Nome is the largest city of its age in the world. Until 1899, when gold was discovered in the sand on the beach, there were only a few Eskimo huts in the place. Before a

month had elapsed after the discovery, two thousand men were digging on the beach and were taking out, on the average, more than thirty thousand dollars per day. Before the end of the year the town contained between five thousand and six thousand people searching for gold with varying results. Some "struck it rich," making thousands of dollars in a few days, while many others suffered miserably

FIG. 71. MINERS AT LUNCH ON THE BEACH, CAPE NOME

from cold, hunger, and disappointment. Every available steamer from Seattle was loaded to its fullest capacity, and many were unable to find passage or to pay the exorbitant fare charged for transportation.

To-day Nome is a city of twelve thousand or fifteen thousand people. It is equipped with telegraphs, telephones, electric lights, hotels, stores, banks, and many other modern

conveniences, for, swiftly following the miner, have gone railroad builders, telegraph linemen and operators, capitalists, surveyors, bankers, and teachers. The city will eventually become the terminus of railroads which will bring it into close touch with the northwestern United States. At the present time the water trip from Seattle takes more than a week. The future of this mushroom city depends almost entirely on the amount of gold to be found in its vicinity. Around this metal centers all its interests. The supply on the beach is nearly exhausted, and miners are going farther and farther inland. Experts tell us that plenty of gold will be found in the deeper rock, and if this prove true, the future of Nome is assured.

During the first years after the settlement of Dawson and Nome, life in these places was extremely primitive. The houses were mere shacks of rough boards, while some of the less fortunate people were obliged to get along as best they could in tents. The sleeping bag lined with fur was indispensable, as blankets and quilts were unknown luxuries. Food was very simple and required little preparation. It consisted chiefly of canned beans, bacon, and beef, supplemented by coffee without cream or sugar.

News from the outside world was slow in reaching these northern cities, and when, in the course of a month or six weeks, the mail arrived, a great holiday was held, while letters and papers from home were read over and over again.

But you are wondering what all these miners from the Klondike and Nome did with their bags and boxes of precious gold dust.

In July, 1898, the United States government established an assay office in Seattle. You have noticed in reading

these pages how often the government steps in and helps any new enterprise. In an assay office the officials receive the metal, determine its value, give the depositor a receipt for it, or its value in money, and finally send it in the form of bars to the mints to be coined.

When the assay office in Seattle was opened, its doors were besieged all day by miners from the Klondike, each with his bag or box of precious dust representing months of suffering and hard labor in the past and years of ease and comfort in the future. In three months more than five million dollars was received at the Seattle office from the homeward bound miners; and this did not include all of the gold mined in the Klondike, for some was still stored in the North and some was taken to assay offices situated elsewhere.

In 1867, when we purchased Alaska from Russia for $7,200,000, it was thought to be a bleak Arctic country, "of more square miles than square meals," and of little use except for the fish and furs which it might yield. The money derived from these have paid for it many times over, to say nothing of the millions of dollars yielded by the gold discoveries. And, bleak and frigid though it is, it is possible, in the more favored portions, to raise the hardier grains and vegetables twelve hundred miles nearer the north pole than on the eastern border of our continent. With its great wealth of fish and furs and its rich mineral deposits, including copper and coal as well as gold, Alaska will become one of the most important portions of our country.

President Roosevelt said of it, when addressing an audience at Seattle, Washington:

> The men of my age who are in this great audience will not be old men before they see one of the greatest and most populous states of the Union in Alaska. . . . I predict that Alaska within the next century will support as large a population as does the Scandinavian peninsula of Europe, the people of which by their brains and energies have left their mark on the face of Europe. I predict that you will see Alaska, with her enormous resources of mineral wealth, her fisheries, and her possibilities which almost exceed belief, produce as hardy and vigorous a race as any part of America.

The excitement of the great rush to the Klondike and to Cape Nome in 1897 and 1898 brings vividly to our minds the different conditions under which the hardy pioneers found their way to the Pacific coast in 1849, when the cry of the discovery of gold in California was raised. The Klondike prospector suffered from cold and hunger, and the California miner from heat and thirst in crossing the then unknown deserts of the West. Death Valley, in southern California, takes its name from the fact that a whole party of emigrants perished miserably in this desolate region while on their way to the gold fields. Some avoided the dangers of desert, and mountains, and Indian attack by a trip across the isthmus, or by a long, stormy voyage around Cape Horn. But through hardships and perils the travelers struggled on, cheered by the news of lucky finds and by songs and refrains like the following, which were sung by the enthusiastic pioneers:

> Ho, boys, ho! To California go!
> There 's plenty of gold, so we are told
> On the banks of the Sacramento!

The fact that California was rich in gold was discovered quite by accident. A sawmill had been built on one of the branches of the upper Sacramento, and the water in the

raceway washed loose some grains of yellow metal which proved upon examination to be pure gold. When the news that gold had been found in California reached the outside world, more excitement was aroused than at any previous discovery, and the effects were in proportion. Two and one half centuries had been necessary to open up the eastern half of our country, but in one year after the discovery of gold in California the western half was crossed by thousands. So many men left the Eastern states that wages became higher in consequence, immigration from Europe increased rapidly, prices rose, and business of all kinds was stimulated. Commerce across the Pacific soon began, and a few years later Commodore Perry opened the ports of Japan to the world. The development of California and other parts of the West brought across the Pacific large numbers of Chinese, who found many kinds of employment. They worked not only in the mines, but as house servants and as field hands on the farms which were soon cultivated; for many of the emigrants found that more wealth was to be gained from the fertile soil than from the mines, and large numbers who came intending to be miners remained as farmers.

The pick, the pan, the rocker, and later the "Long Tom" and the sluice followed each other in quick succession, as half a century later in Alaska and Canada. To all of the devices by which gold is obtained from the soil by the use of water, the name "placer mining" is given. The early devices were simple, as for example the washing of the gravel in the pan. To-day more complicated and expensive machinery is used, and the industry is carried on on a larger scale by a method known as hydraulic mining. Sometimes

gold is found many feet under ground in old river beds which formerly lay upon the surface. To remove the overlying earth a tremendous force of water is needed. By the hydraulic process a powerful stream is directed against the bank or hill which overlies the gold. This washes down the rock and soil into an inclined trough or sluice, where

FIG. 72. PLACER MINING, IDAHO CITY

the gravel is mixed with water. The sluices are paved or furnished with riffles to catch the gold, and mercury is also used in large quantities for the same purpose.

The force with which the water used in this hydraulic process is hurled against the hillside or bank is something tremendous. The pipe which conveys it starts from a higher level and grows smaller at the lower end. The nozzle of

the pipe is oftentimes nine inches in diameter, and the water escapes from this smaller opening with such force that a man struck by it might be instantly killed. Some one has spoken of this powerful stream as "an elongated continuous cannon ball." Sometimes the water has to be brought in flumes or canals for many miles, in which case capital is necessary to make the costly preparation.

The Sacramento and San Joaquin rivers and their branches drain the gold-bearing region of California, and their swift currents from the steep slopes of the Sierras have furnished much of the water needed for hydraulic mining. Whole rivers have been diverted from their beds in order to work the gravel which underlies them. Where hydraulic mining has been conducted on a large scale, fertile farm lands have been covered with sand and gravel. One river has had one hundred million cubic yards of gravel washed from its banks into its bed, raising it seventy feet; in this river valley fifteen thousand acres of fertile farm lands have been buried under loose soil. Laws have finally been passed in the state to protect more effectually the property of the farmers, and the hydraulic method is no longer used on so large a scale.

All the gold mined in our own and in other countries is not found in sand and gravel. It is also buried hundreds and even thousands of feet deep in the hard quartz veins in the rock. Some of the gold in California and most of that in the Rocky Mountains is found in these quartz seams. Deep mining, or quartz mining as it is called, is much more expensive than placer mining, for large sums of money are necessary to get into the depths of the earth where the gold is, and to free it from the rock after it is mined. A

shaft is sunk and at its foot tunnels are laid out, which follow the veins containing the gold, much the same as in coal mines. Most of the gold mines in California and in other states are now of this kind.

After the gold is taken from the mine, it must be separated from the rock — a much harder process than simply washing it free, as in placer mining. The ore comes to the surface in lumps of gray rock varying in size from pieces

FIG. 73. GOLD KING MINE

as large as one's fist to those larger than a peck measure. The larger pieces are broken by machinery into smaller bits before being run between crushers which grind the ore to gravel. This is pounded into a fine gray powder by the stamps,— great bars of steel which fall upon the crushed ore with terrific force and a tremendous noise. In some stamp mills the workmen have to stuff their ears with cotton to prevent the din from making them deaf. In the smelter the powdered ore goes through several complicated processes, one of the most important of which is the mixing

with mercury. The ore is carried by water over tables covered with mercury. This collects the gold and allows the sand to flow on. All the gold, however, is not saved by this process, and, in order to make the separation more complete, the refuse is usually treated with chemicals by a method known as the cyanide process. The pure metal obtained is melted and run into molds, and in this form it is known as bullion.

There is probably much mineral wealth in the Great Western Highland still undiscovered and unworked, although the richest deposits, the bonanzas, the El Dorados, by means of which a man can become rich in a night, have probably all been found. There is much public land in the West which belongs to the government of the United States. Prospectors are always hunting in these areas, not only for gold but for silver and copper, hoping for a rich find which shall belong wholly to them after paying the small sum which the government demands when any one "stakes a claim."

How is it that gold is found on or near the surface in the loose sands or gravels of the river beds, and also is thousands of feet deep in veins of quartz? Originally all the gold which is now found free, that is, in sand or gravel, was deep in the earth in veins or beds in the hard rock. But by upheaval or by slow wrinkling of the earth's crust, the gold-bearing strata have been exposed to the rains and the frosts, the brooks and the rivers, and these and other agents have been at work for thousands of years breaking up and wearing away the solid rock. When it has been worn and broken into sufficiently small pieces, the rivers have been the carrying agents, sometimes transporting the

rock and the gold which it contains for thousands of miles from the place where it was originally deposited. And this is why all placer mining is carried on in or near river beds. Miners soon learned to look in the deeper rocks, of which the river gravel is the wash, for the source of the golden sands.

Our own country is not the only one in which gold is deposited, for it is found in some amount in every country in the world. Before the discovery of gold in Alaska, Australia ranked first in the amount mined, and that country has the honor of producing the largest gold nugget ever found. It weighed several hundred pounds and was of sufficient value to make its possessor a rich man, for it was worth many hundred thousand dollars. To-day, however, the United States stands first in its output of gold, followed by Australia, while next in importance is South Africa. This English colony owes much of its importance to these mines and to its diamond fields. Fourth in rank comes our northern neighbor, Canada, raised to this place by the deposits of the Klondike region. The Russian Empire comes next, her supply of gold, like her other mineral wealth, coming largely from her Asiatic possessions.

All together, the countries of the world produce annually more than three hundred million dollars' worth of gold, a sum sufficient to pay our president's salary for six thousand years. But the whole great sum is not large enough to pay for all the wheat or the corn raised in our country in a year; for gold and silver are not the most valuable things in the world, though many people seem to think so. There is little value in gold itself, only as it has the power to purchase necessary or desirable things. One might starve

with a pocket full of gold. A story is told of some miners returning from the gold fields, each with his bag of yellow dust, which meant freedom from work, and riches for the rest of his days. But in a severe storm, as the vessel was going down, each miner tore his bag from his belt, and cast it from him, knowing that gold, which is almost twenty times heavier than water, would cause him to sink immediately. Of all on board no one was drowned except an ignorant servant who secreted in his clothing as many as possible of the discarded bags.

Government statistics show that Colorado holds first rank in the United States as a gold producer, her annual output amounting to nearly thirty million dollars, or one third of all that mined in the whole United States. Cripple Creek, Leadville, and Denver owe their growth largely to the rich deposits of gold and silver in their vicinity. California ranks second to-day, but her total output since gold was first discovered there far exceeds that of any other state. It is said that the amount of gold mined in the United States since the discovery up to 1848 was twelve million dollars. In the five years following California produced more than twenty times that amount.

Third in rank comes Alaska, raised to that place by the recent discoveries there. Then follow South Dakota, Montana, Arizona, Utah, Nevada, Idaho, and Oregon. Indeed there is no state in all our Great Western Highland where gold is not mined to some extent.

Gold and silver in untold riches in the West, and coal and iron in the East. Black, dirty coal and brown, rusty iron! They seem hardly to be compared with the glittering gold and shining silver, yet their value in practical

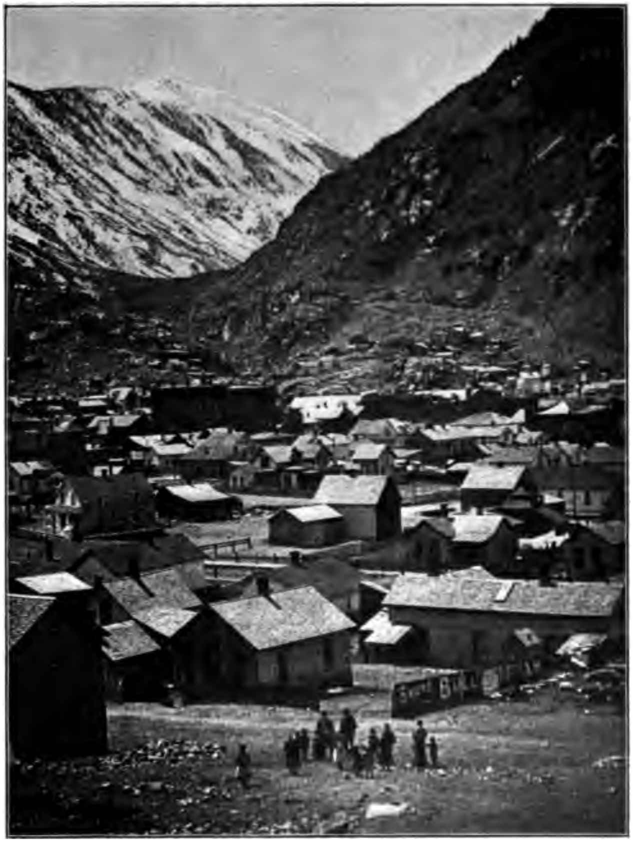


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FIG. 74. A MINING TOWN, GEORGETOWN, COLORADO

uses is far above that of the so-called precious metals. What would run our furnaces, propel our engines, warm our houses, furnish locomotives to draw the cars of ore, and machinery for the gold and silver mines themselves, were it not for the rich deposits of coal and iron scattered through

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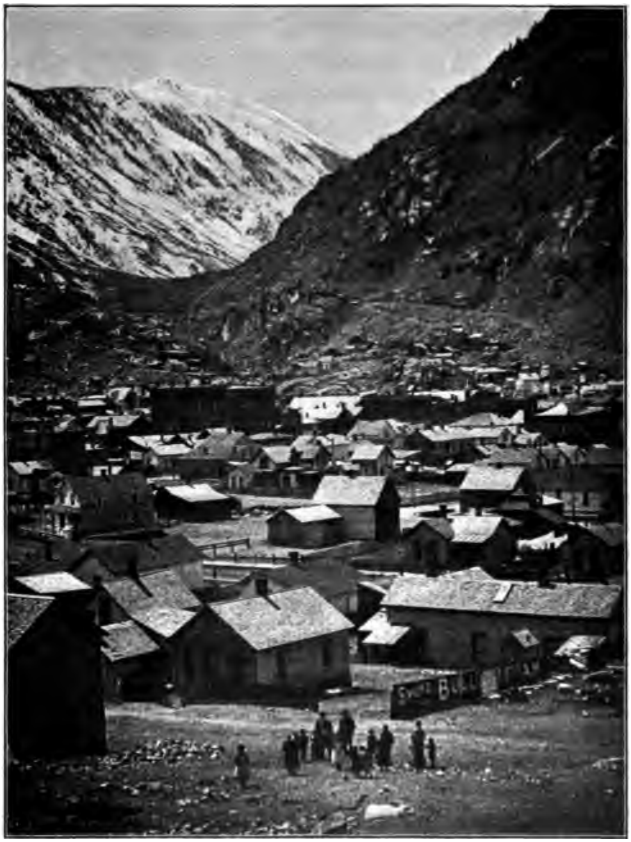


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FIG. 74. A MINING TOWN, GEORGETOWN, COLORADO

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the eastern portion of our country! We could do without gold and silver, even though its lack might inconvenience us, much more easily than we could give up coal and iron.

It seems queer, with all the mineral wealth buried deep in the earth, that gold is the only yellow metal. Probably its attractive color is one of the qualities for which it has always been valued so highly. We know that all nations, ancient and modern, have usually looked upon gold as valuable and desirable. We find it buried with Egyptian kings, and, though four thousand years have passed since the ornaments found in the tombs were worn by living monarchs, the gold is as fresh and pure as if taken yesterday from a Klondike stream or from the sands of Nome. It was to obtain the gold and other riches of India that Columbus set out upon his voyage and discovered instead a new world!

For jewelry, ornamentation, statues, even for medicine, gold is used, for it yields itself readily to many forms. It is soft and easily hammered, easily drawn out into thread or worked into other shapes. The hammering of gold is an interesting process. It is so malleable that it can be beaten into sheets so thin that it would take more than two hundred thousand of them laid one upon another to make an inch in thickness. It is then several hundred times thinner than the paper upon which this is printed.

But the chief value of gold is as a medium of exchange, or money, and in this way it has been used from earliest times. Gold is so soft that it is necessary, in the manufacture of coins, to mix it with some harder metal, in order that they may be more durable. The other metals used are called alloys. Silver and copper are used in the making of our gold coins, nine parts pure metal to one part alloy.

Silver alone would give a lighter color, so copper also is used to preserve the tone.

When we became free from England, we did not wish to use her pounds, shillings, and pence, but preferred to have a coinage system of our own, and soon after the Revolutionary War we began supplying our own money. This was made in the mint which was established in Philadelphia and which for some years was the only one in the country. To-day there are mints in three other cities,— New Orleans, Denver, and San Francisco. The San Francisco mint is the largest in the world.

It is an interesting sight to see, in these mints, the crucibles of melted gold, and then the long yellow ribbons into which it is rolled,— ribbons several feet in length but of just the right thickness to be made into coin. These long rolls are cut into blank coins which are tested to see if they are of the proper weight. This is done in a room where a number of women are seated at long tables, each with a file and weighing machine before her. If the coin proves to be too light, it is remelted; if too heavy, it is filed down to the required weight. The gold dust which accumulates from this and other processes is carefully saved, for in the course of a year it amounts to hundreds of dollars.

The edges of the coins are next rolled as we find them, and the faces are stamped with the proper die, after which they are stored, ready for use, in the vaults of the mint.

## Silver

Silver is usually found in connection with the other minerals. To-day the largest part of the world's supply comes from mines not worked for silver alone — although there are

such mines — but from those in which gold, copper, or lead is the most important mineral, the silver being only a by-product. The largest silver producer in the United States at present is probably the Amalgamated Copper Company, which owns half the mines in Butte, Montana.

Silver is used for much the same purposes as gold, and is subjected to similar treatment to extract it from the ores. While most gold is found on the western slope of the Sierras, the most silver is found on the eastern side, in Nevada. The output of this state has been largely increased by the recent discovery of rich deposits. The center of the silver district is around Virginia City, six thousand feet high on the slopes of the mountains. Rich veins are found also in Colorado near Leadville. One might say that Leadville is a city built on silver, for the silver-bearing ore is not only all around it but beneath it as well.

Although there may be more silver in Nevada than in Colorado, more is mined in the latter state. One reason for this is that in Colorado the veins containing silver run more nearly horizontal, while in Nevada they tip toward the vertical and are therefore necessarily deeper. This makes the mining not only more expensive but more difficult, for the heat is so great in the lower levels of the mine that it is very hard to work there, and some rich mines have had to be abandoned on this account.

You have probably heard of the Comstock Lode in Nevada, at one time the richest silver mine in the world. It was owned by a man called "Pancake Comstock," because, before his wonderful discovery, when he was only a poor prospector, he lived chiefly on pancakes. The Comstock Lode was one of the first to make Nevada famous. It

yielded two parts of gold to three parts silver, and since its discovery more than three hundred fifty million dollars' worth has been taken out of it. It contains one hundred ninety miles of shafts and galleries, many of which are not worked to-day on account of the heat or the thin veins of ore.

Colorado is the banner state in the production of silver as well as of gold, mining each year eight million dollars' worth. Montana ranks second and Utah third.

Mexico and the United States supply the most of the world's silver, each producing annually about thirty million dollars' worth. Most of the smelting of ore for Mexico, and for Canada as well, is done in the United States.

## Topics for Study

I

1. Introduction.
2. A trip to the Klondike.
3. Mining in the Klondike.
4. Cape Nome gold fields.
5. Seattle assay office.
6. Wealth and future of Alaska.
7. Gold in California.
8. Effects of the discovery.
9. Hydraulic mining.
10. Deep or quartz mining.
11. Gold in other countries.
12. Rank of different states in the United States.
13. Comparisons of gold and silver, and coal and iron
14. History of gold.
15. Uses of gold.
16. Money.
17. Silver.

## II

1. On a map of North America, trace a route from Boston to Dawson City, Canada. Name the railroads and the waters on which you would go. Make a list of all states passed through, and interesting or important cities visited. On the map of Alaska, locate all places spoken of in that country.

2. Make a list of and locate the five largest rivers of North America.

3. Why can grains be raised in Alaska twelve hundred miles nearer the pole than on the east coast of North America? (See Chapter IV.)

4. On an outline map, locate all cities of the United States spoken of in this chapter. Color the gold-producing states yellow, and those yielding silver, gray.

5. Write the autobiography of a gold coin.

6. Find in your textbook what fish and furs are found in Alaska.

7. In connection with what other industry have you read of South Africa?

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in previous chapters.

| | | |
|---|---|---|
| Dyea Inlet | South Africa | Utah |
| White Pass | Siberia | Washington |
| Lake Bennett | Egypt | Virginia |
| Cape Nome | India | Seattle |
| Death Valley | Mexico | Skagway |
| Isthmus of Panama | Arizona | Dawson |
| Cape Horn | Oregon | New York |
| Sierra Nevada Mountains | Nevada | Nome |
| | Idaho | Boston |
| Rocky Mountains | Yukon River | Salt Lake City |
| Appalachian Mountains | Sacramento River | Cripple Creek |
| | San Joaquin River | Leadville |
| Australia | Missouri River | Denver |
| Alaska | Klondike River | Philadelphia |
| Canada | California | San Francisco |
| Russia | Colorado | New Orleans |
| Japan | South Dakota | Virginia City |
| France | Montana | |

# CHAPTER XIV

## THE CATTLE AND BEEF INDUSTRY

Would you like to visit the greatest cattle ranch in the world? Then let us go to Texas, the most fitting state because of its size to contain this wonderful ranch. On the great plains in that part of Texas which, from its shape, is known as the "Panhandle," three or four thousand feet above the sea, we shall find the Farwell Ranch. It is hard to imagine a farm larger than a whole state, but this one, with an area of five thousand square miles, is larger than Connecticut. It is now being divided into smaller sections and sold, but originally it was two hundred miles long and twenty-five miles wide, shut in and divided by more than fifteen hundred miles of wire fencing, enough if stretched out in a straight line to reach halfway across the United States.

Two towns are situated within the boundaries of the ranch, and telephone connections from them extend to its farthest boundaries. The upper wire of the fence serves as a telephone wire. This is raised on posts at the gateways, so that teams and high loads can pass underneath. The hundred thousand cattle which live on this farm are cared for by one hundred and fifty cowboys. This seems a small number to look after so many cattle, but a few men can care for a large number of animals.

Think how many cattle we must raise to supply enough beef to feed the eighty million inhabitants of the United

States and to export more than all other countries put together. There must be millions of cattle raised each year, and acres upon acres of grassy plains for them to feed on. The United States leads the world in the production of all live stock except sheep. This could not be true, did we not have our fertile farmlands of juicy corn and our great plains of nourishing grass. These plains lie chiefly east of

FIG. 75. CATTLE RANCH ON THE CIMARRON

the Rocky Mountains, stretching from Texas through Dakota and into Canada, covering an area of more than four hundred and fifty million acres. If all this great area of land upon which the cattle feed were to be divided among the people of the whole country, each man, woman, and child would have a farm of about six acres,— quite enough for a large lawn and a vegetable garden, with land still left to pasture a cow; for if all the cattle of the country

were to be equally distributed, nearly every person in the United States might own one.

On the Western grazing area, as you know, little rain falls, and the coarse grass, though nourishing, is so thin that each animal requires a great deal of land in order to get sufficient food. It is said that ranchmen allow twenty to twenty-five acres to each animal, if it is to find its food winter and summer in the coarse grass. Twenty acres to each animal! Then for one thousand cattle — and many ranches have more than this number — a ranch owner would need the use of twenty thousand acres. Many towns are no larger. You see that the area, the number of cattle, everything on these ranches, is on a large scale.

Formerly nearly all of this vast region was unfenced and open to the herds to wander upon at will, finding their food, winter and summer, on the open range. Now the public land is becoming less each year, for new areas are opened to settlement as irrigation makes it possible to raise good crops. Much land has been worn out, that is, too many cattle have lived upon it, and have nearly destroyed the grass by close feeding and hard trampling. Many ranches, particularly in the southern states, are now inclosed by fences, which shut in also the only available water supply for miles around, so that the open range which is left is practically useless except to the one who controls the water.

In the open country the cattle feed on the lower plains during the winter, but as the hot weather comes they wander higher on the slopes of the mountains, where they find not only more food but trees to shelter them from the hot sun. When the cowboys round them up in the fall,

they are found many miles from their home ranch. In the winter they can wander even farther, for it is not so necessary for them to remain near their water supply, as they can quench their thirst by eating snow, and at the time of the spring round-up they are sometimes one hundred miles from home.

Twice a year all the cattle of the region are gathered together in one place. This is called the round-up. It is perhaps the hardest as well as the most interesting work of the cowboy, and is done chiefly for two reasons. The animals suited for beef must be separated from the rest and shipped to market. This is usually done in the fall, as the cattle are in better condition then than they are after the long, hard winter. In the spring round-up the calves are branded with the owner's name or mark. This is the busiest time of the year for the cowboys, and great preparation is made for it. Wagons furnished with camping outfit and provisions are driven to the gathering place. All the herders of the region unite for the event, for where the animals roam on the open, unfenced ranges, and wander many miles away from the ranches, the cattle of many owners are mixed in the various herds.

The cowboys are awakened in the morning at what seems to us a very early hour. They eat their breakfast of bacon, beans, and coffee, feed their ponies, and by four o'clock or a little later are in the saddle ready for a long, hard day's work. They divide into small groups, and ride away toward all points of the compass over the broad plains, where for miles no cow or steer can be seen. When they are beyond where the cattle are feeding, they begin to drive them in from all sides toward the camping ground.

As the herds of cattle come nearer and nearer together, the dust is raised in clouds. The bellowing of the cows, the shouts of the cowboys, and the racing of the ponies make a scene of great excitement.

When the cattle are massed together, the work of cutting out the calves for branding begins. For this work the cowboys are very particular which ponies they choose. Each

FIG. 76. THE ROUND-UP

rider has brought several with him, and the intelligence of the horse counts for almost as much as that of the cowboy himself. A mother and an unbranded calf are selected from the midst of the herd, and the pony, by urging and pushing and jostling, drives them to the edge of the herd — or rather the mother is driven and the calf follows. When they reach the open, the wild dash for liberty which is usually made by

the calf is suddenly checked. Seizing just the right moment, the cowboy, with a skillful hand, throws his lasso around the hind legs of the animal. The knowing horse braces himself for the shock, and, when the rope tightens,



FIG. 77. BRANDING THE CALVES

A busy day on the Paloduro Ranch, Texas

the calf is suddenly thrown to the ground. Irons have been heating and the brander presses the hot iron on the side or flank of the frightened calf. Of course the branding is painful, but it takes hardly a minute, and it seems to be

the only way by which the cattle can be marked so that each owner can always tell his own.

Sometimes cattle are marked with the initials of the owner's name. Signs that cannot be easily changed are often used instead of initials. Cattle thieves have acquired large herds without buying them, by simply changing a brand. For instance, a man whose cattle were marked with his initials, V. O., began to find that his herds were decreasing in numbers. A dishonest neighbor had added a line to the V, and with the extra letter, A, had changed the brand to his own initials, N. O. A. A circle brand, $\bigcirc$, could be easily changed, as you see, by the addition of straight lines, $\ominus$, $\oplus$. Because of this dishonesty, the brands have become more complicated than they were originally, as the more lines they contain the less easily they can be changed. In some states the laws concerning brands are very strict. In Denver, Colorado, a record is kept of all those used in the state. No one can be like another, and each cattle owner must register his brand as soon as selected. If he purchases cattle already marked, he must add his brand to that which the cattle already bear.

The spring round-up sometimes lasts for weeks. After it is over, the cattle of the different ranches are driven to their summer feeding grounds on the nearer ranges. As the season advances and the dry, hot weather comes, they wander farther and farther for food and water. When the time comes for the fall round-up, when the animals fit for market are selected, the herds are scattered for miles over the plains and on the slopes of the mountains.

The life of the cowboys is monotonous and lonesome. It is a healthful one, however, as most of the time is spent in

before fattening them for market. Great numbers of cattle from the Southern states are sent north to be fattened on Kansas corn, though many Southern farmers are to-day fattening their stock on cottonseed meal.

Because of the difference in climate, the ranches in the northern grazing area are not conducted in just the same way as those in the southern. The winter is too severe in the central and northern areas for the raising of young calves, so this is done mostly on the Southern ranches. After a year or two on a Southern ranch, the steers are sent north to feed, and, being strong and well grown, they get through the hard winter in good condition.

Herds of cattle were formerly driven on foot to the northern feeding grounds and to market, but they are now carried by rail. Special cattle cars are used, in which only a limited number are carried, and at many points men inspect the cars to see that the animals are transported in a humane manner. Short-horned or dehorned animals are taking the place of the long-horned variety, which was formerly raised on the ranches, and there is therefore much less danger from injury on the long trip east. Food and water must be supplied regularly, and many of the cars are fitted with troughs for this purpose. If the journey is a very long one, the cattle must be unloaded on the way, and the exercise thus gained rests their tired muscles, which have stiffened from remaining so long in a cramped position. In the hot season as many as possible of the trains move in the night. This makes it much more comfortable for the living freight, and at the same time prevents interference with passenger traffic. Many hundreds of these cattle trains come from the smaller Western towns,

and deliver their tired, stiffened, bewildered load in the stockyards of Kansas City, Omaha, St. Louis, St. Joseph, Sioux City, and at Chicago.

Do you suppose cattle ever think? If so, what must be their thoughts when they first arrive at the stockyards in

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FIG. 79. SHIPPING BEEF TO THE CHICAGO MARKET, MONTANA

Chicago, the greatest cattle and beef center of the whole world? More than one hundred and fifty thousand cattle, sheep, and hogs live here for a day, and then are changed into beef, mutton, or pork, and so give place to others, which enjoy the comforts of the animal city for the same

brief time. The streets are long and straight, and one might wander in them for twenty-five or thirty miles; the pens on either side are well built, some with roofs, some open, and all provided with food and water troughs. Fifty miles of food troughs! It is hard to believe, but it is really true.

The stockyards are honeycombed with railroads, and every twenty-four hours, chiefly in the night or early morning, many trains roll in, to the very doors of the pens, and unload their thousands of living freight. During the day hundreds of trains depart for the East, loaded with beef or live stock. After the cattle are unloaded in the stockyards, they are allowed to eat, drink, and rest a few hours. Soon, however, they are taken from their pens for their last journey. The crack of the whip, the cries of the drovers, the bellowing of cattle, the bleating of sheep, the squealing of hogs, the buyers and sellers rushing excitedly back and forth, make up a scene of indescribable confusion. After the sale, the weighing and other matters are attended to, and the cattle are taken in charge by the buyers, and are driven off to the various slaughterhouses in the yards. By the end of the day few of the squealing, bellowing, bleating crowd are left to welcome newcomers from the plains.

The slaughtering of the animals has been reduced to a science, and it is quickly and painlessly done at a rate which seems almost beyond belief. Some firms slaughter four thousand cattle a day, an average of eight or more a minute. This is quicker than you could slice steak for your dinner, or peel the potatoes to eat with it. In about half an hour the body of the animal, cleaned, skinned, and ready for quartering, is in the cold-storage room, where it remains

for forty-eight hours. Then the quartering is done, and the fresh beef is loaded on refrigerator cars ready to be shipped to various parts of our country or to Europe.

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FIG. 80. BIRD'S-EYE VIEW OF THE UNION STOCKYARDS, CHICAGO

There are many noted packing houses, some of which do business on an immense scale. The largest ones have establishments in several of the shipping centers, and employ thousands of men in each city. One company, for instance, employs six thousand hands in Chicago alone, and has plants in Omaha, Kansas City, and other places. The

buildings used by these packing firms are immense; those of one company occupy nearly one hundred acres, and one could tramp several miles in the various passages. We wonder sometimes what becomes of the quantities of meat which are prepared in these packing houses and daily sent

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FIG. 81. COOLING ROOM IN A LARGE CHICAGO PACKING HOUSE

away from Chicago and other great packing centers, but you must remember that we are the greatest meat-eating people in the world, and that every person in the United States consumes on the average one hundred and fifty pounds a year. This is much more than is eaten by any

other people, some of the nations of Europe, for instance, consuming less than thirty pounds a year to a person. More than three million tons of beef are produced annûally in our country, and though this seems an immense quantity, yet it is only one third of all the beef which the world eats. In the Chicago stockyards alone there are one hundred firms doing business, and many packing companies are located in other great cities.

We export each year, chiefly to England, France, and Germany, one hundred million pounds of beef. This would be enough to last one person more than one hundred and twenty-five thousand years if he ate two pounds of meat a day. It would be sufficient to supply all the people of Chicago with one pound every day for three months.

Great quantities of beef are sent away in other forms than these large, fresh quarters, for there are canned meats of various kinds, corned beef, beef extracts, and the mincemeat which is sold in large quantities for mince pies.

The making of beef extract is an interesting process, and much care is exercised to have it pure and wholesome. Many women are employed in this department of the packing houses, sealing cans and putting on labels and wrappers. They work very rapidly, and their fingers must fly indeed, for one girl is able to label and wrap nearly three thousand cans a day. The large establishments have their own plants for making cans, labels, and much of the other material necessary in their work.

After the meat is disposed of, the rest of the body of the animal is used for many purposes. Indeed we may truthfully say that to-day nothing is wasted. Some one has said that after passing through the packing establishment

nothing is left of the pig but his squeal. And after seeing the many things which are made from the different parts of the bodies of the cattle, one would certainly think that nothing could be left but the bellow. Butterine and oleomargarine are made from the fat; buttons from the bones and blood; combs from the horns and hoofs; glue from the sinews, bones, and hide trimmings; and other useful articles from the parts of the animal which were formerly thought of no use. Twelve million pounds of glue were turned out in "Packingtown" in one year, besides vast quantities of other manufactures.

Leather is made from the hides and is used chiefly in the making of boots and shoes, an industry of great importance in the United States. Cowhide is used chiefly for the soles of shoes and for the making of patent leather. The largest tanneries are in Milwaukee, though some are found in many other cities and towns. Not all the skins used in this country are native. We import many goatskins from South America and India, and colt- and calfskins from Russia. But our great cattle and sheep ranches have made it possible for the United States to lead in shoe manufacture. We make more than two hundred and fifty million dollars' worth of boots and shoes each year, Massachusetts contributing nearly one half of this amount. Brockton is the largest shoe-manufacturing city and contains the largest shoe-manufacturing plant in the world. Lynn comes next in rank, while Haverhill and other cities contribute many thousand pairs to the annual output. St. Louis, with its cattle industry and its stockyards, is an important shoe city.

A great cattle industry is carried on in South America

on the plains through which the La Plata River and its branches flow. Here is America's great future rival. Here we might ride for hundreds of miles and see only herds of cattle, immense flocks of sheep, and droves of wild horses. The horses are valued chiefly for their hides and hair, and it is interesting to know that the hide is as valuable without the animal inside as with it.

The duties of the gaucho, as the cowboy is called in South America, are much the same as in the United States, for the round-up and branding are carried on in a similar manner. The climate is somewhat warmer than in our great West, and all through the year the cattle find plenty of food on the Pampas, so that no special food provision for the winter needs to be made.

After the marketable steers are "cut out" at the round-up, they are sent to Buenos Aires, the largest city in South America, where they are prepared for market in much the same way as they are in Chicago or in any great packing center in the United States. Before 1880, cattle were valued chiefly for the hides and tallow, but now great quantities of beef are sent from Buenos Aires to England, France, and Germany. By tracing the voyage on the map you will see what a long, hot trip it must be, for the vessel must cross the equatorial regions on its journey north. But the meat is frozen and packed in refrigerator ships, and so reaches Europe in good condition.

You have probably tasted some extract of beef, or have seen different brands advertised in papers and magazines. The great works where one variety is prepared are situated in a town called Fray Bentos, in Uruguay. If you look on a map of South America, you will find this town near the

La Plata River, and therefore in the great cattle region, for the Pampas include much of Uruguay, as well as Argentina and Paraguay. In this establishment, or *saladero*, as slaughtering houses are called in the musical Spanish language, six thousand men are employed, and a thousand animals are killed every day.

Some of the European countries produce more beef than Argentina, but they contain so many people that it is all consumed at home, and more has to be imported. On account of her scanty population, Argentina is able to export more beef than any other country except the United States.

We have not yet spoken of the dairy products, — the milk, butter, and cheese,— for dairying is carried on chiefly in a different section of the United States, and in a very different manner, from the cattle industry in the West.

Most of the dairy farms are farther east than the cattle ranches. The best land for them is in the fertile region near the Mississippi River, toward the northern part of the United States. From here the dairying area stretches eastward through Minnesota, Michigan, Illinois, Indiana, Ohio, through the three northern Middle Atlantic States, and through New England, Vermont being especially noted for her product. In recent years the industry has made a great advance west of the Mississippi River in the Dakotas, Kansas, Missouri, and in the Pacific States. Perhaps you have never thought of dairying as an important occupation, but you may think differently when you know that our dairy products are worth more than our wheat crop.

In every state of our country some cattle are raised for dairy products, but nowhere else to the same extent as in

the areas named. In the Mississippi Valley quantities of corn and alfalfa are grown, and make excellent food for cows which give rich milk and yellow butter. Those which wander on the great plains of the West can thrive on the coarse brown grass, but their milk is thin and blue, and the butter made from it is of a poor quality. The cattle which

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FIG. 82. MILKING COWS, BRIARCLIFF FARMS, NEAR NEW YORK CITY

make the best beef are not those which produce the most or the richest milk. Shorthorns, Herefords, and several other breeds are well suited for the production of beef, while for dairy purposes the gentle Jersey, the black and white Holstein, the belted Dutch, and the red and white Ayrshire are in greatest favor.

As you ate your breakfast this morning, did you think how many million pounds of butter must be made in order that every boy and girl may be able to eat it on bread? We make annually nearly one billion five hundred million pounds. This is enough to give every inhabitant of the



FIG. 83. CHURNING BUTTER WITH OLD-FASHIONED DASHER CHURN EAST AURORA, NEW YORK

United States nearly twenty pounds a year, and most of it is really eaten in this country, for we cannot spare much to be exported.

Have you seen pictures of an old-fashioned New England kitchen, where the housewife is standing beside the churn

moving the handle up and down to "make the butter come"? At the present time, most of our butter is made in large creameries, though in some towns you may still find the old-fashioned churning by hand carried on.

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FIG. 84. THE GREAT CHURN WHICH CHURNS EIGHT HUNDRED POUNDS OF BUTTER AT A TIME, EAST AURORA, NEW YORK

A creamery receives great quantities of milk, which is poured into a machine called a separator. This is made to revolve at a high rate of speed, and the cream, being lighter than the milk, comes to the top and flows out through a tube, while the skimmed milk comes out through another

tube below. The cream is churned so as to collect the fat globules of which the butter is composed. This solid portion is then kneaded, either by hand or by machinery, to remove all the liquid possible. It is then salted and packed.

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FIG. 85. THE SEPARATOR AT WORK. BRIARCLIFF FARMS, NEAR NEW YORK CITY

There are more than three thousand cheese factories in the United States, which every year manufacture more than three hundred million pounds of cheese. A small amount is made by hand on the farms, but nearly all our product is made by machinery in the factories. Cheese is the curd

which forms when milk sours. In the factories the souring is hastened by the addition of rennet. The whey or liquid portion is drawn off, and the curd is cooked, drained, salted, and pressed. It is then cured in a cool room. The process called ripening takes place in the curing room, determining the particular flavor of the cheese.

Though we produce annually enough cheese to give about four pounds to each person in the United States, we import from Switzerland and other European countries several million pounds more. Our country is not yet so famous for dairy products as Holland, Switzerland, and Denmark. Their butter and particularly their cheese are considered much better than ours. Denmark exports more butter than any other country in the world.

Milk is such a nourishing food that we find it used in many countries, though it is not always obtained from the same kind of animal. The Laplander has his reindeer, the Arab his camel, the people of India their buffaloes, and mountain peoples their different varieties of sheep and goats.

## Topics for Study

### I

1. Journey to Texas.
2. Description of the Farwell Ranch.
3. Area of cattle ranching.
4. The round-up.
5. Branding.
6. Ranch life.
7. Shipping to market.
8. The packing houses.
9. Cattle products.
10. The industry in other countries.
11. Dairying.

## II

1. Reread Chapter IV and tell the cause of the lack of rain in the grazing area.

2. Color a map showing arid, semi-arid, and humid areas.

3. Color a map showing the grazing area. Make a list of all states wholly or partly included in this area. Locate cities connected with the cattle industry. Find the railroads over which cattle are shipped to these cities from the ranches. Name the railroads by which beef is distributed.

4. Describe a route from Chicago to London. From Buenos Aires to London. Of what other products, besides meat, have you read which might be shipped over these routes?

5. Make a collection of labels from canned-meat preparations. Learn the names of some of the important packing companies and the cities where the meat was prepared.

6. In an outline or hectographed map, locate the "shoe cities." Trace the railroads by which the raw material may be taken to Milwaukee for tanning, and thence carried to cities for manufacturing into shoes.

7. In connection with what industries has South America been mentioned in this book? In what two industries may Argentina rival us in the future? Trace a route from Buenos Aires to Liverpool.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in previous chapters.

| | | |
|---|---|---|
| Texas | England | New York |
| Dakota | France | Denver |
| Colorado | Germany | Austin |
| Kansas | Holland | Kansas City |
| Iowa | Switzerland | Omaha |
| Wisconsin | Lapland | St. Louis |
| Minnesota | Arabia | St. Joseph |
| Illinois | India | Sioux City |
| Nebraska | Argentina | Buenos Aires |
| Ohio | The Pampas | |
| New York | Paraguay | Mississippi River |
| New England | Uruguay | La Plata River |
| Canada | Chicago | |

# CHAPTER XV

## THE SHEEP AND WOOL INDUSTRY

Have you ever thought, as you put on your heavy winter coat, or pulled the warm blankets around you, of the animal that yields the wool of which they are made, or of the work which is necessary to change the wool into cloth? Great quantities of fiber are needed for cloth, blankets, carpets, and other articles, and millions of sheep must be raised to furnish it, for one animal yields only from five to ten pounds at a shearing.

It has taken many years of careful tending, feeding, and breeding to change the thin, coarse-haired sheep which roamed over the mountains of central Asia into the heavy, long-wooled sheep of to-day. The wild sheep of Asia were covered with short, fine wool which kept them warm, and also with a growth of long, coarse hair which served for a raincoat.

Sheep were domesticated in very early times, for we read in the Bible that story, with its tragic ending, which tells of Joseph being sent on the long journey to his brethren as they tended their flocks at Shechem. On this lonely walk he wore his "coat of many colors," which was probably made of wool, for this material was used by ancient peoples long before cotton was known, or before the flax fiber was spun into linen.

As civilization spread, these Asiatic sheep were introduced into the Mediterranean countries. On the high, dry

plateaus of Spain they fared well, and with care and breeding gradually developed into the famous Merino sheep, which produce the finest wool for manufacturing purposes.

The early explorers brought with them to America the animals which had been useful to them in their European homes, and the sheep, which gave them food and clothing, would not of course be left behind. From the animals which Columbus on his second voyage brought to America the first great flocks of the Southwest were probably descended. The English settlers also brought sheep with them from the farms at home, that they might not lack warm, serviceable garments in their hard pioneer life.

Many of the sheep raised in the early colonial days lived a comfortable life, for they were tended and petted by the quaint little Puritan children. The sheep on the ranches of our great Western plains, and those on the smaller farms east of the Mississippi River, live a very different life. On these farms at least a thousand are usually kept, while on the great ranches farther west it is not uncommon to find from twenty-five to fifty thousand owned by one man. Can you imagine what a sight this must be, to see all these thousands of sheep crowded together into one flock?

On a great sheep ranch it is customary to divide the animals into flocks of one or two thousand or even more, and to send them off to feed under the care of a herder. One man with a dog, without which a sheep herder is of little value, can easily care for two thousand or more. If he is on horseback, the number may be increased to five or six thousand. The herder makes his camp near some stream of water or a lake, or sometimes by a well. Here he stays at night with his flock. During the day he drives

them off on the plains to feed. When the grass is all eaten in that vicinity, he moves his camp to some other place where water may be found.

In the summer the herder and the flock wander higher and higher on the mountains, but with the approach of autumn



FIG. 86. SHEEP GRAZING ON THE PLAINS

they come down to the plains again. During the winter they stay near the ranch, where in many cases a rough shelter for the animals and some food, usually alfalfa, are furnished.

In the early days of ranching, when no provision was made for the long, cold winter, vast numbers of sheep

perished, and the only return the owner realized from them was from the sale of the skins. To-day it is considered more economical, as well as more kind, to see that they do not suffer so much during the cold weather.

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FIG. 87. THE LONE MONTANA SHEPHERD AND HIS BEST FRIEND

If the herders are to take the sheep many miles away, and stay for a long time, a camp wagon is sometimes provided. This is built with a high canvas top and is packed full of things by the use of which the herder can make himself comfortable. There is a stove in one end where he can cook his food, which consists largely of canned goods,

varied occasionally by a tender lamb from his flock. There is also a folding shelf which can be let down and used for a bed, and in this narrow bunk, warmly wrapped in his blankets, a herder can lie safely through a severe storm, for the wagon is so wide that even the strongest winds do not tip it over.

The herder's hardest work comes in the spring, when the lambs are born, for they are feeble and need much care. A severe storm coming at this time is very unfortunate, for the little lambs, cold, wet, and helpless, die by hundreds. Some ranches provide a "lambing van." This is a large wagon which is driven from herd to herd, gathering up the lambs and taking them to the ranch, where they are cared for and given food and shelter.

The herder has many other duties beside those of which we have spoken. A sheep or a lamb makes a dainty meal for the mountain lion or the wolf, and such intruders must be guarded against, especially at night. The coyote, or prairie wolf, is both wise and sly, and knows well that he must keep out of reach of the herder's rifle and out of sight of the dog. But if a single sheep wanders off by itself, it is pretty sure to become the prey of the coyote. At night on the lonely plain, his howling cry is often heard in the still air, and bonfires, lanterns, flags, rockets, and other means are used to keep him away from the sheep.

Another duty of the herder is to keep a close watch for poisonous grasses, and, if these are found, to drive the sheep to some other feeding ground. Certain diseases also must be guarded against, and an eye kept on the water supply, which must be unfailing.

Rattlesnakes kill many sheep, particularly just after shearing. When the heavy wool is on, the poison rarely

penetrates the skin. There is perhaps more danger from these reptiles to the herder himself than to his flock. If bitten while off on the range, far from any habitation, he may die from the effects of the poison before help can be obtained.

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FIG. 88. COYOTES

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when straying, watches them at night, and guards against the fierce mountain lion which would attack them. Without the shepherd dog it would be impossible to carry on sheep raising on the large scale that is common in the West. These dogs are often finely trained by their masters, and obey not only their voices and spoken directions, but in some cases even signals given by the hands or arms.

The large sheep ranches in the United States and Canada are on the great plains east of the Rocky Mountains and in the valleys between the ranges, in much the same area as the cattle-grazing grounds. Many sheep are also raised on the smaller farms east of the Mississippi River. Ohio ranks second as a wool-producing state. Montana is first, for more than six million sheep are raised within her boundaries. Six million sheep! An immense number. If they could be gathered into one great flock and made to pass in front of you, one by one, while you counted steadily day after day at the rate of one sheep per second, from six o'clock in the morning till six at night, you would not finish counting all the sheep in Montana for nearly five months.

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There has been much conflict and hard feeling between the cattle and sheep owners, for cattle will not feed well on

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In the chapter on the cattle industry, you remember, it was stated that the same kinds of animals are not raised for beef as for dairy purposes, for the flesh of a cow which gives rich milk does not make the best meat. A similar thing is true in regard to sheep. Those that yield the most or the finest wool are not those which, when slaughtered, make the best mutton. The Merino sheep has the finest wool in the world, while the Southdowns, which yield wool of an inferior grade, are the best for food. Sheep owners are trying to breed an animal equally valuable for mutton and for wool, and both are being constantly improved by their efforts.

The shearing was done formerly on the ranch, but now the sheep are often driven to some other place near the railroad station, as it is thought cheaper to drive the sheep than to pay for moving the wool. Except in some of the more southerly states, sheep are usually sheared but once a year, in late spring or early summer. June is considered the best month, as the wool is then in good condition, and there is less danger of the animal taking cold after losing his warm, heavy coat, though much care has to be exercised to prevent this.

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skeletons of thousands of sheep. They had perished in a long, cold rainstorm which had unfortunately come just after they had been sheared.

Shearing used to be done by hand, with peculiar shears made for the purpose. It was slow, hard work, though not painful to the animal, for a sheep was very seldom cut by a skillful shearer. But hand work in almost any industry is considered too slow for these busy times, and machines are fast taking the place of fingers. So in the sheep industry a machine has been invented to do the shearing. The shears are fastened to a rod which is moved by power. The sheep come in, one by one, through a narrow alley, and in a few minutes the poor, bewildered animal is released, shorn of his woolly coat, which lies heaped in a pile on the ground.

Before going off to feed again on the range, the sheep are made to swim through a trough containing a cleansing, wholesome bath. It is not very agreeable, but is necessary to check or cure certain skin diseases to which they are subject. Though the bath is sometimes taken at other times of the year, it does more good if given just after shearing for then the liquid can more easily penetrate the skin.

The wool is packed into bags or bales holding from three hundred to one thousand pounds apiece. Much of this is sent to the East for manufacturing. More than half of all the woolen cloth made in the United States is woven in New England. Consequently great quantities of wool are sent to Boston for distribution. Boston ranks next to London as a wool market.

From what you have studied about cotton manufacturing you can easily select some of the cities where wool is made

into cloth. Lawrence and Lowell in Massachusetts, Providence in Rhode Island, Manchester in New Hampshire, and New York City are all especially noted, but Philadelphia leads them all.

Most of the wool produced in the United States is of a medium grade. We import some of excellent quality, from

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FIG. 90. SHEEP PENS, MONTANA

which we manufacture our finest cloths, and also much which is coarse and heavy, to use in making carpets.

Between three and four hundred million dollars' worth of woolen cloth is made in the United States every year, and although this seems a tremendous amount, yet England manufactures a still greater quantity. We do not compete

with other countries in the manufacture of very fine cloth, but our heavier goods, flannels and blankets, are unsurpassed. Ours is the greatest carpet-manufacturing country in the world, making a greater quantity and a larger variety than any other nation. The carpets made by hand in some of the Eastern countries, Turkey, Persia, or India, are more beautiful in color and texture than anything that can be made by machinery. But next to the Oriental rugs come those of American manufacture. Philadelphia, and Yonkers, New York, are particularly interested in this branch of manufacture.

Many different kinds of goods are made in the great woolen mills. Chief among them is cloth for men's suits and ladies' coats and dresses. Think of all the different kinds of woolen cloth which are made up into such wearing apparel, and you will have some idea of the great variety which is manufactured. Then there are the carpet mills, the yarn mills, and those which make all kinds of felting for floor and table coverings, linings, hats, and many other purposes.

In the making of felt, the wool is wet and heated in order to mat it closely together. Great quantities of it were formerly used for felt hats, but of late years this use of wool has declined, because the finer felt hats of to-day are made of the fur of the rabbit, raccoon, and other animals.

When the fiber arrives at the factory, it is packed as it came from the sheep, good, medium, and poor wool all mixed in the same bale. The first thing to be done is to pick it over and sort it, putting the different qualities in different piles. Then, as it is all very dirty, it is washed or scoured, as this process is called in the mill. So much

dirt and foreign matter are mixed with the wool that when it has passed through the various cleansing solutions it has lost about one half of its weight.

After drying upon frames of wire netting, it is carded by a machine which lays the fibers straight and even. Passing through other processes, it is soon ready for spinning. Wonderful machines twist the fiber into long threads, which are then twisted with other threads, until the desired number and strength are obtained. It is interesting to unravel a piece of yarn and find the fibers of which it is composed.

After spinning, the yarn or thread is wound on huge spools and on bobbins, or done up in large skeins. In these forms it is shipped to the woolen and worsted mills. There it is dyed and made ready for weaving, which is similar to the weaving of cotton.

After the cloth is woven come the washing, the steaming, the shrinking, the pressing, the measuring, the folding, and finally the packing in neat papers such as you see in the stores. The cloth is ready to start on its journey to the wholesale dealer, then to the retail dealer, and then perhaps to your mother, who goes to the store to purchase a suit of clothes or material for a winter dress.

Our great woolen mills need so much material that we use not only all of the three hundred million pounds obtained from sheep raised in the United States, but we have to import half as much more from other countries. Australia, Argentina, and China all send us wool, which we get largely by way of London, for that city, you remember, is the largest wool market in the world.

Have you any idea how many yards of cloth can be manufactured from such a great quantity of wool? If we

America. It seems odd that the wool must be sent on such a long journey to be manufactured. How much better it will be for the South American people when they have their own mills and factories.

In former years the flesh of the sheep in South America, like that of their cattle, was considered of little value; but now the meat from two hundred thousand sheep is exported every month. What a tremendous amount! No wonder that Buenos Aires, the city from which most of it is shipped, has the largest frozen-meat plant in the world. The mutton as well as the beef must be frozen and packed in refrigerator ships for the long ocean trip, so that it may be received in good condition.

Most of the European countries raise many sheep, Russia more than all the rest; but all the wool which is produced, and much more besides, is needed for the clothing of the people at home, so that little or none is exported. The great mutton and wool exporting countries are those which have vast unpopulated areas where the sheep may roam. Chief among these are Australia, Argentina, and South Africa. In South Africa the industry is important and furnishes work for many people, for there is found the dry, healthful climate and the salty food which the sheep like so much. Most of the wool from South Africa is sent to England for use in her great factories. Two of her largest, most important colonies, South Africa and Australia, are noted for the amount and the excellent quality of the wool they produce, and both send immense quantities to the mother country.

But we must not think that all woolen cloth is made from the covering of the sheep; that of other animals is

also used, though in much smaller quantities. The wool from which cashmere dresses and shawls are made comes from an animal whose coat has furnished material for cloth since very early times. The Cashmere goat lives in the principality of Cashmere, in India; hence its name. It is



FIG. 91. ALPACAS IN PERU, SOUTH AMERICA

found also in Tibet. Cloth made entirely of the wool of this goat is very expensive. Most of that which we call cashmere cloth is a combination of wool and cotton.

The alpaca, another kind of goat which lives on the Andes Mountains in South America, yields material from

which a cloth of the same name is made. A comparatively new cloth is mohair. This is made from the covering of the Angora goats, which are raised in great numbers in South Africa. Other countries are attempting, with some

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FIG. 92. SHEARING CAMELS IN EGYPT

success, to raise this goat, but at present it is chiefly found in South Africa.

Even the gaunt, ungainly camel is used to help furnish us with yet another kind of dress goods. Camel's-hair cloth is easily distinguished by the long hairs left scattered over the surface. This cloth is, however, rare, most of the

so-called camel's-hair cloth being made from the hair of the cow and other animals. You notice in the picture that the shearing of the camels is done by hand. Modern machinery finds its way but slowly into Eastern countries, and most work is still done in the same way that it was hundreds of years ago.

## Topics for Study

### I

1. History.
2. Introduction of sheep into the United States.
3. Sheep herding.
4. Area of sheep raising in the United States.
5. Number of sheep raised in the United States.
6. Conflict between cattle and sheep owners.
7. Kinds of sheep raised.
8. Sheep shearing.
9. Woolen manufacturing.
10. Slaughtering and packing.
11. Other uses of sheep.
12. Sheep raising in other countries.

### II

1. Compare the cities and countries spoken of in this chapter with those mentioned in the cattle industry. How many do you find mentioned in both?

2. Name four products of South Africa and four of Argentina. To what countries are they shipped?

3. Name six products obtained from the sheep.

4. Tell the story of a piece of wool from the time it leaves the sheep until it is woven into cloth.

5. Add to your interesting collection of school maps by pasting on the proper country a picture of the animal from which wool is obtained there.

6. Read the description of the shearing in "Ramona," by Helen Hunt Jackson.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this and in any previous chapter.

| | | |
|---|---|---|
| Asia | Russia | Lawrence |
| Australia | Mississippi River | Lowell |
| New Zealand | Great Plains | Providence |
| Argentina | Pampas | Manchester |
| South Africa | Rocky Mountains | New York |
| India | Andes Mountains | Philadelphia |
| Canada | Ohio | Chicago |
| England | Montana | Buenos Aires |
| France | New England | San Francisco |
| Germany | Boston | |

# CHAPTER XVI

## LUMBERING AND ALLIED INDUSTRIES

Large forest areas are found in many parts of the United States, and three hundred thousand out of our whole population of eighty million people are engaged in the lumber industry. As the forests of Wisconsin are yielding to-day large quantities of lumber, let us see what life in the woods there is like. The foreman of a lumber camp, who is to have charge of the winter work, is usually busy in the late summer looking up his men, arranging for his teams, and laying in provisions. Taking with him some of the men he has engaged, he starts in the early fall for that part of the forest where the felling is to be done.

As they leave the beaten track, the "tote-road" has to be made. This is a rough way opened through the woods by the felling of trees, and through this passage the teams find their way to the spot where the camp is to be located. All the horses and wagons soon make their appearance, bringing a variety of goods. There are provisions of many kinds, as well as tools for the workmen, mattresses, blankets, stoves, and perhaps lumber for the camp, if they are to build other than a temporary one. If it is only for the winter, it will probably be made of rough logs cut down near the spot.

After the men and provisions arrive, of course the first thing to be done is to get the camp in readiness. To provide a winter home for fifty or sixty men and many horses

time between supper and bed. The men are called in the early morning and after a hearty breakfast start for the woods. They usually work in pairs, using, not axes as in the olden days, but crosscut saws. These are several feet long, with handles at each end. The men stand on either side of the tree, and each alternately pulls the saw toward

FIG. 95. FELLING FIR TREES IN OREGON

him. By means of wedges put into the cut, the tree can be made to fall in any desired direction. So expert do these men become that they can determine within a very few inches exactly where the tree will come crashing down.

While some of the men are thus engaged, others find plenty of work of a different kind. Some are assigned to the task of making the "log-road." This is the path over

which the logs are to be drawn to the river or railroad. Great pains are taken to make it as smooth as possible, in order that very heavy loads may be drawn over it. The trees and stumps are first cleared away, after which the road is sometimes plowed, scraped, and shoveled to make it even.

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FIG. 96. A HOLIDAY AMONG THE FALLEN MONARCHS

It is usually made lower than the ground on either side, instead of higher, as our ordinary roads are. This is done in order that there may be no opportunity for the loads to slue. After the first snowfall, the road is rolled hard and smooth, and sometimes a sprinkling cart is run over it to give it a

coating of ice. On such a road a team of four horses can haul many tons.

Another piece of work that has to be attended to in the fall before freezing weather comes is the clearing of the river down which the logs are to be floated in the spring. All stumps, snags, and everything else which might obstruct the way must be removed in order to make the work of driving the logs as easy as possible for the rivermen.

FIG. 97. SLEDDING

Now that the camp is finished, the river cleared, and the road to it built, let us go into the forest where the men are at work. After the trees are felled and the limbs cut off, the trunks are sawed into logs of the desired length. This varies from ten to one hundred feet, depending somewhat, of course, on the height of the tree, though the average length is less than thirty feet. The logs must then be taken from the spot where they lie, to the log-road, where they

are piled upon the "skidway." This consists of two large logs, several feet apart, fastened at right angles to the road. Here they remain until they are loaded upon sleds to be drawn to the river. The different skidways are piled high with logs before the teaming begins, for this is usually postponed until the ground is covered with snow.

FIG. 98. A BIG LOAD

Loading is an art in itself. It is no easy task to make the load as heavy as the horses can draw, and yet have every log stay securely in its place until the strong chains can be fastened around them. If a log should slip, it might mean the breaking of a man's leg or back, or even his death if he should be caught under it, so the men who do this work need to become very skillful. The picture shows how

many logs can be drawn at one time over these roads, and the skill of the men who load them.

In early days lumber was considered comparatively worthless unless it was near some stream. At the present time it is often necessary to go a long way into the woods after it, so far indeed that in some regions railroads are

FIG. 99. THE LOG PILE

built to carry the logs to the mills instead of using rivers at all. In Wisconsin there are many streams penetrating the forest region, the most important of which are the Chippewa, Black, and Wisconsin rivers. These and their branches furnish waterways down which each year many thousand logs are floated to the mills.

We have followed the loaded sled through the icy road in the woods to the river. There we find great numbers of logs resting on its surface, waiting for the warm weather to break up the ice. When the stream is open, the river drivers will start the logs on their voyage down the Yellow River into the Chippewa, and down this into the Mississippi and to the city of Winona, which, like most places along the upper Mississippi, is noted for its lumber products.

FIG. 100. A LOG JAM

The journey of the logs down the river is often exciting, for some of them are sure to get caught on stump, rock, or snag, and the others pile up higher and higher until the whole river is obstructed. This means hard work for the river drivers, for a "jam," as they call it, is one of the things they most dread. It is dangerous work climbing out on the slippery logs to loosen the "key log," which is the one that has caused all the trouble. If it gives way suddenly, the driver has to jump for his life out of the way

of the moving mass. It is often weeks before the drivers arrive at their destination. During this time they live on a house boat or raft which usually accompanies the logs. The cook is as important a character here as he is in the lumber camp, for the men are cold and wet and hungry, and long for some appetizing food and a few minutes' rest and warmth.

FIG. 101. THE RIVER HOUSE

Many different companies use the same river. Each log is marked with the name or sign of the owner, but all float down together until they come to the end of the voyage, where the booms are located. A boom is a water yard with a log fence. Lines of logs are fastened together end to end, and are stretched out into the river to form a sort of inclosure. Here the logs are separated and each one is driven into the boom where it belongs.

The logs pass from the boom to the sawmill, where the scream of the swiftly flying saws is deafening. If some staid old Puritan could visit a modern sawmill, he would surely think that we had in these days witches more powerful than any of the olden times. For it seems nothing less than miraculous to see log after log snatched up from the water, fastened upon a table, and quickly sliced up. The

FIG. 102. THE BOOM

pieces are as quickly carried off to be made into boards of various sizes and kinds, shingles or laths. In the modern mills all this is done by the aid of saws and other machinery without the touch of the human hand. Such wonderful saws as there are, and so many kinds! Circular saws as large as your dining-room table, gang saws all moving together, and band saws which fly so fast that they look like a plain, straight piece of steel, — all whizzing and screaming

for more. No wonder that forests are fast disappearing, when men are hustling to feed the thirty thousand greedy sawmills of the United States, in which thousands of logs are changed each day into material for houses, furniture, boats, carriages, and many other things. It is said that more than twelve thousand square miles of forest land must be cut off every year to supply this great demand.

How different our lives would be if there were no forests to supply our many needs. As we look at chair, desk, table, picture frames, pencils, boxes, penholders, churches, school houses, wooden tools, and wagons, and think of all the many ways in which wood serves us, we begin to realize something of the importance of our forests. The value of the lumber cut in the United States each year is equal to that of all the iron, gold, and silver mined here in the same time. It is such an immense quantity that from it we could make a pile a mile long and a mile wide and higher than a five-story building. If it were possible to construct a sidewalk to the moon, the lumber cut in our country in one year would be sufficient to make, out of plank two inches thick, a walk five feet wide, with plenty of material for the supporting crosspieces.

But you are asking, Where in this country of ours do trees grow large enough and in sufficient number to yield this enormous quantity? Of course, trees, and many of them, grow in every state, but if we wish to visit the great lumber districts we must go to one of five regions.

The oldest lumber area, that is, the one where lumber has been obtained for the greatest number of years, is in the northeastern part of the United States and includes the northern half of Maine, New Hampshire, and Vermont.

It reaches westward into New York and northward into Canada, where lumbering is one of the most important industries. Stretching eastward from the White Mountains through Maine is a forested region larger than the state of Massachusetts. Fifty years ago, from this New England area, one half of all the lumber used in the country was cut. Now it furnishes less than one seventh. The industry here is diminishing year by year, for as the lumber grows scarcer it cannot be prepared for market in large enough quantities to make it pay. This is the region of yesterday, and the lumber industry, like so many others, has moved westward and southward.

You may infer from its name, the Pine Tree State, that the forests in Maine are made up largely of pine trees. More white pine than any other kind of wood is used in the United States for building purposes. So much has been taken from the forests of Maine, that not enough is left to induce men to carry on lumbering on a large scale. Many spruce trees are found here, however, and although it is a poor kind of timber for building purposes, it is very useful for making paper. Most of the paper manufactured to-day, except the finest grades, is made from wood pulp, chiefly spruce, instead of from rags, as was formerly the case.

The pulp is shipped in great quantities from Maine to other states, but large paper mills have lately been erected near the forests themselves. One of the largest paper mills ever built is situated at Millinocket, where, but a few years ago, the songs of the birds and the whispering of the breeze in the tree tops were the only sounds to be heard. Now the buzz of machinery drowns all other sounds, and a busy town of three or four thousand inhabitants is engaged in

making paper. Nearly all the people are dependent on this one industry, and the great mill turns out daily one hundred and fifty tons of newspaper.

At Rumford Falls is another concern which may develop into the world's greatest producer of book paper. Here also postal cards for the United States government have been

FIG. 103. LUMBER AT PAPER MILL AT MILLINOCKET
(Courtesy of the United States Department of Forestry)

made at the rate of three million per day. A large paper-bag mill and an envelope factory, employing hundreds of hands, are near by.

With all these paper factories and others like them using such enormous quantities of wood, it seems as if the spruce forests must soon disappear entirely, as indeed they have in many localities. But the proprietors of these mills,

who have spent millions of dollars in buildings and machinery, are not so unwise as to use all the material which makes their business such a profitable one. Experts direct the men who fell the trees, and none are cut which are less than nine inches in diameter. By the time the smaller ones have reached this size, young trees have sprung up which in turn will replenish the forests, and so a continual growth is assured.

Another region which is fast becoming one of yesterday is the one we have described in the vicinity of the Great Lakes, embracing the states of Wisconsin, Michigan, and Minnesota. Here also the great pine forests are disappearing before the work of the woodsman. As this industry moves northward through these states, the lumbermen with their rough camps, buzzing saws, and ringing axes, are succeeded by farmers, who settle upon the cleared land and earn a comfortable living by raising sugar beets, grain, potatoes, and sleek, fat cows.

Millions and millions of feet of pine timber have been taken from these lake states. Thousands of pioneers went out into the treeless plains to plant fields of wheat and corn, or to raise cattle, sheep, and hogs. What would they have done for lumber to build their houses and barns, and to make their furniture, if there had been no forests near? The opening up of Iowa, Kansas, Nebraska, the Dakotas, and other states would have been a much greater problem if the wealth of pine in the lake region had been lacking. No other forest area has been, perhaps, of so much value in the settling and developing of our country. It has served its chief purpose, however, and never again will such enormous quantities of lumber come from this area as in the

early nineties. The supremacy in this industry has passed to other fields; and to visit the greatest lumber region of to-day we must go to the South, the land of the tall Southern pine.

All the way from the Carolinas to Texas are great forests of pine, of a different variety from that in the North and of a harder wood. More men find work in the forests and sawmills of this section than in any other lumber region of the country, with the result that from this great forest belt comes one third of all the lumber which is produced.

In the South, logging is carried on all the year round. Lumbermen do not depend on rivers, but have built many hundreds of miles of railroad to carry the logs from the woods to the mill. At the mills, the logs are kept in water storehouses, reservoirs, or artificial ponds until they can be sawed, because in the water they are not so quickly attacked by bugs of various sorts. The water also soaks out the sap and prevents discoloration of the wood.

But years are required for the growth of a tree, and too many lumbermen care little for the future supply, if they can but line their pockets with money by to-day's toil. So these Southern forests are fast disappearing, and, if the felling goes on at the present rate, very few of any great extent will be standing by the middle of the century. Of course lumbering will be carried on in this southern region, as well as in the other areas named, for many years to come, but it will be in a smaller way, and the output will not go far toward supplying the enormous amount which we use every year.

Now let us go to the area of the future, which lies in the West, that wonderful West of ours, where everything is

conducted on such a large scale: where acres are counted in hundreds instead of tens, where cattle and sheep are owned by thousands instead of hundreds, and where trees grow that overtop all others in any country. In Oregon there is a greater area covered by forests than in any other

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FIG. 104. FLUMING LUMBER FROM THE MOUNTAINS IN OREGON

state. In Washington and Oregon are the pines and firs, tall and straight as a church spire, light and strong, the best timber in the world for the masts of vessels.

With all this wealth of wood, no wonder that some of the streets in Tacoma and other Western cities are paved

with this material. No wonder that hundreds of ships loaded with timber sail every year from Seattle, Portland, and San Francisco, to China, Japan, South America, the Philippines, and the Hawaiian Islands. No wonder that many rafts, containing from fifty thousand to one hundred thousand dollars' worth of lumber, and large enough to require from seventy-five to one hundred tons of chains to hold the logs in place, are towed from the Columbia River to San Francisco.

But to see the very largest and oldest trees in the whole world we must go to California. Trees are growing there, strong and vigorous, which were in their youth when the wise men from the East journeyed to Bethlehem to see the Christ-child. If Columbus, when he discovered the new world, could have penetrated to the depths of these forests, he would have found them in the prime of their life. Some of them can even look back to a birthday four thousand years ago and more. They have stood there, strong and silent in the sunlight and in the pale moonlight, while a hundred generations of men have been born, lived, and died; while a hundred wars have been waged; while kingdoms have risen and decayed. It fills us with awe and wonder to think of any living thing so old.

Most of these giants are still perfect, showing no signs of decay. Some, which have fallen and lain for hundreds of years, are still as sound as when they first came crashing to the ground. There were probably once upon the earth many of these trees, but the only living representatives are found in California, chiefly in two groves. One of these, the Mariposa, is situated on the western slopes of the Coast Mountains, and the other, the Calaveras, which

contains the very largest trees, is located on the western side of the Sierras. In the Mariposa Grove are one hundred and twenty-five of the giants, besides many others which, anywhere else, we should call very large indeed. One of these trees would yield sufficient lumber to build a house. Some have bark two or three feet thick. A schoolroom could be built, or a dance held, upon a single stump. Many

FIG. 105. THE TUNNEL TREE

of the largest of these trees have been named for some noted person. The General Frémont received its name from the pioneer who, in the early forties, explored California and the surrounding country. Finding no better place, he used for his camp its hollow trunk. In visiting the Mariposa Grove, thirty-one of us stood inside this tree at one time; and it could have accommodated several others, without more crowding than one often finds on a street car.

California contains large areas covered with the redwood, to which these giant trees are related. Much timber, valuable for its lasting qualities and its polish, is taken yearly from these forests. It is said that before the earthquake in San Francisco nine tenths of the city was built of redwood. Shingles made from it are excellent, and are sold all over the United States.

All the trees of which we have spoken thus far are of soft wood, which, though good for houses, shingles, and low-priced wooden articles, is not suitable for fine furniture and the things which require a high polish and excellent finish. So we must look for one other area in our country, the hard-wood region, where walnut, oak, cherry, chestnut, birch, beech, and other deciduous trees grow. These trees, which lose their leaves in winter, are usually of harder wood than the evergreens.

The hard-wood varieties are found scattered through our country in many different places, but the region which has yielded the greatest quantity is in the vicinity of the Ohio valley. Though great areas have been cleared and given over to farming, there is still much lumber near the Ohio River, in Ohio, Indiana, Illinois, West Virginia, and Kentucky.

If you will find on the map the five lumber regions which have been described, you will notice the advantage which they all possess in being on or near great bodies of water. The New England area lies near the ocean, with the good harbors of our north Atlantic coast close at hand. The north central region has an increased value because of its location near that wonderful inland water route through the Great Lakes. The Pacific forests border the western

ocean, while the Southern-pine region lies near the Gulf and the Atlantic ports. The hard-wood region is in the Ohio valley, where transportation is afforded by the Ohio and Mississippi rivers.

Besides these lumber regions in the United States there are other countries where we may find this industry carried on. You have probably read stories of the great, dark forests of Russia, and the danger to travelers from the wolves which live in them in great numbers. Most of the animals from which Russia obtains her valuable furs — the wolf, fox, squirrel, sable, ermine, and marten — live in these woods; and the wisdom of the Russian government, in preserving her forests and in carrying on lumbering carefully, serves to protect the fur industry as well.

Our northern neighbor, Canada, has a larger forest area than any other country and exports to the United States immense quantities of lumber and pulp. England also buys largely from this colony of hers.

Having located the most important forest areas of the world, you can easily find some of the cities which are engaged in the shipping and manufacturing of lumber. Bangor is the largest lumber market in the eastern area of the United States. It is situated on the Penobscot River, just where the tide of the ocean and the current of the river meet. Here the tide checks the current so that it is difficult to float the logs much farther down the river. Consequently an immense lumber industry has grown up there. You will find many lumber markets on the Maine coast and on the Penobscot, Kennebec, and Androscoggin rivers, at Portland, Bath, Augusta, Lewiston, Auburn, and other places. If you look for information about Maine in cyclopedia or

geography, you will notice how many of its cities are engaged in some form of the lumber industry. Some make furniture, some ships, some paper pulp, while in some the logs are simply changed into boards and shipped away in that form.

In the Great Lake region there are many cities, especially in Michigan, Wisconsin, and Minnesota, where sawmills are humming, and furniture, carriage, match, and other factories are busily engaged in making articles of everyday use. Chicago is the largest lumber market in the world, for it is very favorably situated for receiving and distributing the product. Grand Rapids is surpassed only by Chicago in furniture manufactures. Detroit, another lake city, is noted for its manufactures of railway and street cars. You have doubtless often seen on the cars the name of some Detroit company.

Could we take a trip down the Mississippi, we should find, in nearly every city of importance as far south as St. Louis, some manufacturing which has been made possible by the northern forests of pine. This is particularly true of cities located where there are falls in the river, or near the mouths of smaller streams, down which the logs can be easily floated. At Minneapolis the lumber industry is very important. The Falls of St. Anthony furnish the city with power, and the forests around supply the wood, so that the city has been able to send to Western settlers materials for homes, and tools to work with. In return, the wheat raised on the western plains has been sent eastward and made into flour, so that Minneapolis has rapidly grown into a great lumber and flour center.

Going down the river, past Red Wing, Winona, Dubuque, Davenport, Quincy, and St. Louis, we should see rafts and

booms of lumber, sawmills, and factories turning out all sorts of wooden articles. You will notice that St. Louis is so situated that it can receive by water pine from the lake region, hard wood from the Ohio valley, and yellow pine from the South. Street cars are made there in great numbers, the sales in one year amounting to fifteen million dollars.

FIG. 106. PORT BLAKELY MILLS, THE LARGEST IN THE WORLD
WASHINGTON

We have said that one third of all our lumber product comes from the South, and we find there many cities manufacturing and shipping this article. Pensacola and Mobile rank in this respect higher than all other Southern cities, each of them sending vessels laden with wood or manufactured wooden articles to more than one hundred ports in

our own country and Europe. Charleston, Savannah, New Orleans, and Jacksonville also ship great quantities. Furniture, doors, and blinds are made in large quantities in Macon, Montgomery, and Atlanta.

As Washington and Oregon are so largely covered with forests, you would expect to find there much shipping and manufacturing of lumber. In Tacoma, Seattle, and Portland these manufactures are of greater value than any other, and immense quantities of lumber in the rough as well as the finished products are shipped from these cities.

More than eighty million dollars' worth of furniture is manufactured in the United States every year. One would think that this would be enough to furnish all the houses that might be built in a long time, but next year we shall need just as much more. The railroads are the largest consumers of hard wood, for they use great quantities for ties and cars. Some railway and telegraph companies have purchased large areas of land on which they have planted young trees, in order to be sure of a future supply of lumber for ties, cars, poles, and other equipments.

As you look at the shoes which you have on, you may not think of any use of lumber connected with them; yet the hard, stiff hides of which they are made were probably changed into soft leather by the use of an acid which comes from the bark of the hemlock tree. Some of the greatest tanneries of the United States are in Pennsylvania, where this tree grows in great abundance. An artificial extract, which may in the future take the place of the hemlock bark, is already used to some extent in tanning leather.

Did you ever hear of "naval stores" — tar, pitch, resin, and turpentine — for which North and South Carolina and

Georgia are noted? These also are a product of the forests. They are called naval stores because they are used so largely in shipyards. Tar is a dark-colored liquid obtained from the pines of these southern states. It is used for

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FIG. 107. CHIPPERS ON TURPENTINE FARM, GEORGIA

coating and preserving wood which is exposed to the water, and also in medicines and in soap making.

North Carolina is sometimes called the Turpentine State, because so much of that article is obtained from the sap of her pine trees. It is used largely in medicine and in the making of paints and varnishes. Resin is a by-product

peasant classes can afford them. Besides being used for clothing, an immense quantity of rubber is made into tires and belting, for to-day rubber is being used largely on carriages, automobiles, and bicycles.

Another curious product, though not a sap, which comes from a South American tree, is that bitter medicine, quinine. It is obtained from the bark of the cinchona tree, which grows in the mountainous regions of Peru and Ecuador.

Cork is another product obtained from the bark of a tree, — the cork tree of Spain. As the duty on manufactured articles is usually greater than on raw materials, most of the cork is imported in the rough state and is made in this country into stoppers for bottles and into other articles. You have probably seen powdered cork, for grapes imported from Spain are often packed in it.

The camphor tree of Japan yields a fragrant oil which we use in our homes and which enters into the manufacture of gunpowder. When Russia was at war with Japan, little camphor was exported from the latter country, as she needed it in the gunpowder which she was then making in immense quantities. Because of this, camphor became very expensive.

The tree that is perhaps most useful to the most people in a variety of ways is the bamboo, which grows in China and Japan. One could build a house and furnish it almost entirely with articles made from this wood alone. It is used for the framework of houses, furniture, tools, boats, rafts, and many other things. It is not easy to think of any article which serves in so many ways as the bamboo does the Chinese and Japanese.

Mahogany, ebony, and rosewood are all tropical woods and are valuable because they are so hard and take such a

fine polish. Pianos, tables, and other articles of expensive furniture are made from them.

Though we have mentioned so many uses of trees, we must not omit one which is perhaps the most important, — their influence on the water supply of the earth. Can you believe that on every bright, sunny day a large tree draws from the deep soil, or from hidden springs which its rootlets reach, several tons of water, which it gives to the air through its leaves? When you think that nearly an equal amount is passing into the air through the leaves of every medium-sized tree, you can see what a great influence forests have in supplying the air with needed moisture which later falls in rain, and you can understand the injury to crops that may result from the wholesale destruction of these "water-breathers."

Trees not only give much moisture to the air through their leaves, but they help to keep it in the ground. The long roots penetrating the soil make it open and porous, and the covering of leaves acts as a thick, soft cushion. When the rains come, much of the water sinks into the soil and is held there as in a reservoir instead of running off as it falls. The deep shade of the forest trees protects the soil from the sun, and evaporation does not take place so rapidly. The moisture is therefore left to sink into the ground instead of being quickly taken up into the air again. If the forests are removed, the soil becomes hard and compact; there is no cushion of leaves to hold the moisture, and it flows off, filling the brooks and rivers to overflowing and causing damage by floods. When the dry season comes, as there is no reserve water left in the soil to replenish the streams, they dry up, and the whole region suffers from drought.

Thus the cutting off of the forests is a serious menace to our country; but most lumbermen think of nothing but the value of the wood as represented in dollars and cents. If they thought of the effect on the farming region around of laying bare acres of wooded land, they would cut only trees of a certain size, leaving the young growth to replenish the old.

A serious danger to forests comes from fires. In the state of Washington, which you remember is largely covered with timber, more has been destroyed in a single year from fires than the woodsmen have cut in that time. Fires originate in different ways. Locomotives are responsible for a good many, and campers, hunters, and tramps are careless about matches and camp fires. From these small causes are started great conflagrations, which destroy thousands of dollars' worth of lumber. Railroad companies often clear the land for a certain distance on either side of the track, so that sparks are not so likely to set fire to the underbrush.

People have awakened to the fact that the cutting off of the forests and the destruction by fires are a serious menace to the wealth of the country. The division of the Department of Agriculture known as the Bureau of Forestry is doing all in its power to preserve the forest growth. All civilized nations of the world practice forestry. Indeed it has been said that a nation's advance in civilization may be measured by its care of forests. More than one fifth of all the forested land in the United States is in state or national reservations. Of this amount nearly one hundred fifty million acres are now controlled by the national government. Taken all together this is about as much as is included in

New Mexico and Arizona. These lands are patrolled by guards, the animal life is protected, new trees are planted, and fires are guarded against. Lumbering is done in a scientific way, so that the young growth will replenish the old; the brush is not left to dry and become tinder for forest fires.

From the rent of the grazing lands included in the reservations, and from the sale of lumber, the government realizes each year between one and two million dollars. Some of this income is returned to the counties in which the forests lie, and is devoted to public schools and roads.

It has been made possible for school children to help in restoring the woods and in beautifying streets and grounds. Every state has set apart an Arbor Day, for the purpose of planting trees, vines, and shrubs. In other countries this plan is carried out on a larger scale. In Sweden alone six hundred thousand trees were planted in one year by school children.

In the spring of 1907 President Roosevelt wrote this message to the children of the United States:

> Arbor Day (which means simply "Tree Day") is now observed in every state in our Union, and mainly in the schools. At various times from January to December, but chiefly in this month of April, you give a day or part of a day to special exercises, and perhaps to actual tree planting, in recognition of the importance of trees to us as a nation, and of what they yield in adornment, comfort, and useful products to the communities in which you live.
>
> It is well that you should celebrate your Arbor Day thoughtfully, for within your lifetime the nation's need of trees will become serious. We of an older generation can get along with what we have, though with growing hardship; but in your full manhood and womanhood you will want what nature so bountifully supplied and man so thoughtlessly destroyed; and because of that want you will reproach us, not for what we have used, but for what we have wasted.

A people without children would face a hopeless future; a country without trees is almost as hopeless; forests which are so used that they cannot renew themselves will soon vanish, and with them all their benefits. A true forest is not merely a storehouse full of wood, but, as it were, a factory of wood, and at the same time a reservoir of water.

When you help to preserve our forests or to plant new ones, you are acting the part of good citizens. The value of forestry deserves, therefore, to be taught in the schools, which aim to make good citizens of you. If your Arbor Day exercises help you to realize the vast benefits each one of you receives from the forests, and how by your assistance these benefits may continue, they will serve a good end.

(Signed)

Theodore Roosevelt

## Topics for Study

I

1. A journey to a lumber region.
2. Life in a lumber camp.
3. Methods of felling, hauling, river driving, etc.
4. Sawmills.
5. Value of our lumber product.
6. Lumber areas in the United States.
7. Lumber regions of the world.
8. Cities connected with the lumber industry.
9. Uses of lumber.
10. Dangers to forests.
11. The forest service.
12. Arbor Day.

II

1. Complete the following sentences:

Canada has —— than any other country.

Trees which —— their leaves are usually formed of —— wood.

Chicago is the —— market in the world.

We get —— from Japan, —— from Brazil, and —— from Peru and Ecuador.

2. On an outline map of the United States, color the five lumber areas a pale green. Write the names of the states included, sketch in rivers, and locate the cities connected with the industry.

3. What railroads run from Minneapolis to states farther west? What products form some of the freight? What is carried back to Minneapolis?

4. Sketch the Mississippi River. Add the lumber streams flowing into it. Locate on it at least six cities connected with the lumber industry.

5. Tell all the differences you can between lumbering in the northern United States and in the southern portions. What resemblances in carrying on the work can you think of?

6. Make a list of as many hard-wood trees as you can; of those yielding soft woods.

7. Make a list of the articles in your schoolroom which are made of wood; of those in your home.

8. Tell three advantages of the position of Minneapolis; of St. Louis.

9. Name twelve uses of trees.

10. On a map of South America, write the names of all countries you have studied in this or in other chapters. Write in each country the name of the product obtained there. In what other chapter have you read of cork? Explain the effects of forests on rainfall.

## III

Be able to spell and pronounce the following names. Locate each place and tell what was said about it in this chapter and in any previous chapters.

| | | |
|---|---|---|
| New England States | Iowa | Japan |
| Southern States | Kansas | Peru |
| Pacific States | Nebraska | Ecuador |
| Wisconsin | The Dakotas | Brazil |
| Michigan | | Philippine Islands |
| Ohio | Canada | Hawaiian Islands |
| Indiana | Mexico | |
| Illinois | England | Detroit |
| West Virginia | Russia | St. Louis |
| Kentucky | China | Minneapolis |

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FIG. 110. DRYING FISH IN GLOUCESTER, MASSACHUSETTS

There is this difference however. In Gloucester the flowers, instead of being laid on the graves of dead soldiers, are scattered on the waters of the ocean, in which so many of the men of the city have found a final resting place.

Formerly great quantities of fish were found near the shores of Canada and northern United States and were caught by men each alone in his dory. Now, however, this inshore fishing, as it is called, is of little importance compared with that of the deep sea. Though there is less danger in the former method, it lacks the inspiration and excitement of the life of the deep-sea fisherman.

For three miles out from the shore, fishing is controlled by the nation whose land the water washes. Beyond this limit the people of all nations have equal rights.

Let us see what the life of a deep-sea fisherman is really like. Supplied with provisions, nets, lines, trawl, bait, salt, and other necessities, the crew sets sail in early June for a four or five months' trip to the banks of Newfoundland, nine hundred miles away. These banks are stretches of shallow water reaching out more than two hundred miles from shore. The submarine banks have been built up through long ages by the sediment deposited by the two great ocean currents which meet there. The icebergs, too, which come as far south as this, bring much soil with them, and the wash from the land aids in the work. Shellfish of various kinds live and die here, thus helping to build up the plains under the water.

This shallow water is the home of many small fish, and for this reason is visited by the larger kinds, particularly cod, which feed upon them. It is by following the movements of small fish that schools of larger ones are located.

One of the chief ways of catching cod is by trawling. A line, or trawl, often more than a mile in length, has attached to it, about a yard apart, many short lines from three to six feet long, each weighted and baited. Dories, each carrying a trawl and manned by a few men, put out from the schooner. When some distance away, and near where they have reason to think fish are plenty, they anchor one end of the trawl line, then row off a sufficient distance and anchor the other end. The long line is made to float on the surface of the water by means of cork.

While these men are out in the boat, perhaps a heavy fog shuts them in, for during much of the year dense fogs hang over and around the banks, making navigation extremely dangerous. The cold air over the Arctic Current meets the warm, moisture-laden air over the Gulf Stream; the contact causes the vapor to be condensed into fog. Hurriedly finishing their work, they row, as they suppose, toward the vessel. But the wind and current may have shifted, and, though they have a compass, they may be moving every moment farther away from any chance of rescue. The trawl and the heavy fish endanger them still further by their great weight, and heavy seas may break over the boat. And yet, until all hope is gone, no fisherman will cast overboard the catch which he has been at such pains to secure.

In his "Fishing Industry of New England" Professor Tarr writes as follows:

In order to set the trawl and to remove the fish from it, men must leave the vessels in their dories. If a snow squall arises, or a fog sets in while the men are out, they are apt to be separated from their schooner, and, drifting about, become hopelessly lost in the ocean. Every year lives are lost in this manner, and very often men

are adrift for days before being picked up, perhaps crazed by thirst or almost starved or badly frozen.

In some years over two hundred men are lost from the port of Gloucester, and every year there are scores of lives sacrificed. The result is that the percentage of widows and orphans in Gloucester is unduly large, yet the freedom, independence, and excitement of the life, added to the possibility of profit, induce men to engage in the industry. But the wives and mothers ashore, lacking the excitement, wait, watch, and pray, spending sleepless nights listening to the roar of the storm waves with fear and trembling, for they know that this very storm may rob them of their dear ones. Then when it is time for the return, they watch and listen, and, alas, in far too many cases, anxiety gives place to fear, then to dread uncertainty, and finally to hopeless certainty that the vessel will never again enter port and that no one will ever know more than that it lies at the bottom of the sea.

Another means of catching fish, especially mackerel, is by means of a seine. This is a huge net, with which the fish are surrounded; the bottom is so arranged that it can be drawn up, making a sort of bag. The following description of seining a school of mackerel is taken from an article by A. W. Dimock, entitled "With the Gloucester Fishermen," printed in the *Outlook:*

Mackerel are alert and shy. We followed them in silence and darkness, our solitary lantern hidden in a bag at the end of the dory. The stern of the seine boat was heaped with half a mile of net, one hundred feet deep, weighing, with its sinkers, three thousand pounds. Beside the net, ready to pay it out, were two of the crew. Another handled the long steering oar, while the captain in command stood upon the piled-up net where he had jumped. The forward end of the boat was filled with nine oarsmen. Only the cook and gasoline engineer were left on board the schooner. The former was at the helm with duties enough to keep him awake. He was to trim the sails, to follow the boats by the hour through the Egyptian darkness, always to be near but not too near, and never to alarm the nsn. He was not to be run down, and if possible he was to avoid running down any

other member of the fishing fleet or even the unlighted seine boats with which they might crowd the waters. He was to have a hot supper and warm beds always ready for the seventeen hungry men.

When within two hundred yards of the mackerel and a little ahead of their course, one end of the net was given to the dory, which remained stationary, while the net was paid out from the larger boat as it was rowed rapidly in front of the school. When half surrounded, the fish struck the net and dashed hither and thither in wild alarm. They swam toward the dory and were frightened back by the splashing of the oars. Before they found the gap in their environment, it was closed and they were prisoners.

A long line fixed to the bottom of the net was drawn in, pursing the net as it was pulled aboard by a windlass, until the portion remaining in the water inclosed twenty thousand pounds of mackerel in solid mass.

His work on the seine boat finished, the captain came on board the dory and was quickly rowed to the schooner. With his hand upon the wheel, as he laid the schooner beside the net with exactness, he spoke of needful haste, for the curious reason that in the very cold water the fish soon become exhausted and their dead weight unmanageable. Twenty feet of the top of the net was made fast along the schooner's rail, while in the seine boat a dozen Titans heaved and strained and struggled with ten tons of wriggle and flop and slime. Deep in the mass the captain plunged a scoop net with handle twenty feet long and iron mouth three feet in diameter. When filled, it called for six men at the tackle to hoist it on board. Each minute a solid stream of fish poured on to the main deck, filling every space and crevice, burying boxes, barrels, and coils of rope, and mounting above the quarter-deck until that too was covered and the men were working in a sea of fish, the incoming tide rising to their waists. For a strenuous hour the light of torches illumined the faces and silhouetted against the night the forms of men pursing the burdened net.

The emptied net was piled on the quarter-deck, but no rest came to the men. No fisherman may undress until all the fish are dressed. Trays were hastily erected for splitting, gibbing, and salting. Fish were shoveled upon these trays and split from head to tail by a slash of the knife along the side, sometimes at the incredible rate of sixty to the minute by a single man. When split they are tossed to the

gibber, who removes the parts of the fish not used for food. They are then dropped into barrels which are flooded with salt water as fast as filled. When the decks have been cleared of fish, the trays are covered with salt in which are dipped the mackerel taken from the wash barrels.

There are three great fishing centers for cod and mackerel. All the countries washed by the waters of the North Sea are engaged in this industry, Norway leading. The second region is the northwestern part of the North Atlantic, stretching from beyond Cape Race to Cape Hatteras. In this section the fisheries around Newfoundland exceed all others in value. The third great fishing center is the northwestern coast of the North Pacific Ocean. In these waters also are found those submarine banks which are the best breeding places and feeding grounds. The fisheries of Japan are perhaps the most noted of this region.

No part of the fish is useless. The flesh, tongue, and sounds are eaten, the offal and bones are used in a fertilizer known as fish guano, the swimming bladder aids in the manufacture of isinglass, the roe is used for bait in the sardine fisheries of France, and from the liver is made cod-liver oil, a well-known medicine. Immense quantities of glue are made each year from the skin and bones, one firm in Gloucester using several thousand tons each year. From the refuse not used in the glue factories, with the addition of other materials, hundreds of tons of fertilizer are made annually by the same company.

## Salmon

The story of the salmon is more interesting than that of any other fish. It is a salt-water fish, and yet it is caught

in fresh water. That seems a contradiction, but it is nevertheless true. The salmon, for the greater part of its life, lives in the ocean, perhaps not very far from the mouth of some river, — for example, the Columbia, for it is in this vicinity that the greatest salmon industry in the world is carried on. When the time comes for the fish to lay its eggs, it leaves the ocean and swims up the river. After it leaves the salt water, the Pacific salmon loses its taste for food and eats little or nothing. When it reaches the smaller branches of the river it chooses one which rises in a lake, seldom those which have their source in springs or smaller streams. Why the salmon does this is not known, unless it is that they wish to rest in the quiet waters of the lake while waiting to lay their eggs. How the fish can tell, at the place where the branch joins the main stream, what kind of source has given rise to the tributary, is a curious and unexplained fact.

Many of these salmon streams have falls and rapids, but these are little hindrance to the gamy fish. It is an interesting sight to see a thirty- or forty-pound salmon leap up over falls sometimes ten or twelve feet high and land safely in the smooth water above. So many of the salmon streams have been obstructed by dams for manufacturing purposes that laws have been passed requiring runs to be made which shall make the passage over the falls easier for the fish.

In some small stream a pair of salmon select a spot possibly a thousand miles from the ocean, and by using their heads and tails dig a nest in the gravel bed. In this nest from two thousand to six thousand eggs are laid. Many of them are devoured by some hungry trout, or carried downstream in the flowing water. The parent salmon are not

fat and sleek as they were when they started on their long journey up the river, for you must remember they have been practically without food since leaving the ocean. They are much battered and worn from their task of digging the nest, and the female is weakened from laying the eggs. Both

FIG. 111. SALMON LEAPING OVER FALLS
(Courtesy of Dr. R. D. Harlan, George Washington University)

in looks and actions they are very different from the strong, handsome fish which left the waters of the Pacific some weeks or months before. They never attempt to reach the ocean again, but, their life work ended, they die in the fresh water.

When the young salmon which are hatched from the eggs are yet very small, less than an inch in length, they begin

the journey down the river, floating most of the time with their heads upstream, so that food will more easily come to their greedy mouths. If they are hatched far inland, as many are, it may take them several months to reach the ocean, — if indeed they ever reach it, for many of them become the prey of larger fish. Those which are fortunate enough to complete their journey make their home not far from the shore, never going up the river again until fully grown

FIG. 112. A FISH TRAP

and ready to spawn, when they make their way into fresh water, never to return. The salmon of the Pacific Ocean differ in this respect, it is said, from their Atlantic relatives, who go up the streams every year. In May or June, when, fat and plump, they swarm up the rivers, the salmon fishermen begin to gather their harvest.

There are several methods of catching them. In the deeper waters gill-netting is common. An immense net, sometimes more than a quarter of a mile long and thirty or

forty feet wide, buoyed up on the surface by corks on the upper edge and held down in the deep water by weights on the lower, is put across the path of the salmon. The fish swim into it and put their heads through the meshes, which catch behind the gills and hold them fast.



FIG. 113. FISH WHEELS IN COLUMBIA RIVER, OREGON

Where the water is more shallow, salmon may be caught either by trapping or seining. The traps are a comparatively modern device made on the principle of a wire fly cage, into which the unsuspecting insect goes, but from which his fly intellect is not sufficient to teach him his way out. The

traps are in the form of a great inclosure, or yard, surrounded by netting, entered by a narrow, crooked path; and, once in, the salmon seldom finds its way back to the open water. Seining is an old method of catching other fish as well as salmon, and the method of using the seine has

FIG. 114. SALMON AT CANNERY

already been described in the story of the cod and mackerel fisheries.

The fish wheel is a curious method of catching salmon in parts of the river where the current is swift. A broad wheel, with wire nets like baskets fastened to its rim, is attached to the end of a boat or pier. As the wheel is turned by the current, the nets enter the water one after another, and the fish are caught in them. As the wheel revolves, lifting the net with it, the fish are turned out into

a kind of trough. In a sail up the Columbia, many of these fish wheels may be seen on either side of the river, and many tons of fish are caught in this way in a single day,

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FIG. 115. BUTCHERING SALMON

Interior of salmon-canning establishment, Astoria, Oregon

one "fish story" stating that in twelve hours enough were caught to sink the boat.

The canning of salmon has reached a degree of speed and science which is truly marvelous. Some of the canneries of Astoria, Oregon, a town famous for this industry, are situated directly over the water. The salmon are first

cleaned, then by sharp knives run by machinery are cut into lengths suitable for canning. In the modern establishments the cans are then filled by machinery which seems almost human in its mechanism. One part of the



FIG. 116. FILLING CANS

Interior of salmon-canning establishment, Astoria, Oregon

machine holds the fish and the other crowds it into the cans. Then they roll on their way through the factory, into the cooking room, and through different processes, until they finally roll themselves into the labels and are ready to be sent away to all parts of the civilized world.

Salmon are found only in the cool waters of the north temperate zone. The industry is carried on in both the North Atlantic and the North Pacific oceans, but the greater numbers and the largest, finest varieties are found in the

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FIG. 117. SHIPPING DEPARTMENT OF A SALMON-CANNING ESTABLISHMENT, ASTORIA, OREGON

Pacific. The annual catch of the western coast states and Alaska is more than one hundred million pounds. In colonial times salmon were very plentiful in New England streams. The Merrimac River is reported to have been so filled with them during the spring migration from salt water

that they were often crowded out of the water upon the dry banks. The damming of the mill streams and overfishing

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FIG. 118. OYSTER TONGER FISHING FROM SIDE OF THE BOAT CHESAPEAKE BAY

are the causes which have led to the extermination of the salmon and other fish in many of our eastern rivers.

## OYSTERS

Our next visit will be to Maryland, for the most extensive oyster fisheries in the world are found in Chesapeake Bay.

There are three ways in which the oyster industry is carried on: obtaining the oyster from its natural beds, *oyster* planting, and oyster farming. If the first method

were the only one in use, the oyster would soon be a delicacy of the past, as few would be left to lay the eggs to produce another generation. Less than half of our supply is obtained in this way. Artificial raising is necessary to



FIG. 119. "BOARDING" THE TONGS IN CHESAPEAKE BAY

supply the demand, which is steadily increasing. The most simple means of keeping the stock plentiful is by planting, and in order to understand this we must know something of the life of the young oyster.

Oysters lay many eggs, from which millions of young ones are produced. Unless conditions are very favorable, only a small fraction of these live to be three years old, at which age they are considered to be in the best condition for the table.

When the eggs are first hatched, the oyster is so small as to be invisible to the naked eye. Millions of these swim

in the water, but many of them fall a prey to the gaping jaws of some fish swimming past, are smothered in mud, or chilled by a cold current. When about two weeks old and perhaps only one fifteenth of an inch in diameter, they



FIG. 120. DREDGERS USED IN SAILING CRAFT, BALTIMORE MARYLAND

search for some hard, clean surface in the depths of the water on which to fasten themselves for a permanent home. Oysters are never found on a muddy bottom; so long as the surface is hard it matters little what the material is, whether rock or shells or other substance. Here the oyster, firmly fastened to the clean surface, lives out its span of life.

Oyster planting consists simply in placing the young oysters upon bottoms favorable to their growth. If left to themselves, they fasten so thickly upon the hard surface selected that many have no room to grow. In planting they are dropped into the water over the selected spot,



FIG. 121. "SHUCKING" OYSTERS, OYSTER HOUSE, BALTIMORE MARYLAND

usually during the spring and fall. Care is taken to scatter them so that all the young oysters may have a chance for development.

An oyster farm is more complicated. Here they are reared from eggs, and every precaution is taken that all conditions of temperature and purity of water may be favorable,

thus increasing the number which live and thrive to a much greater proportion than where natural conditions prevail.

Oyster farming is carried on near New York, on the shores of Long Island, in Connecticut. The getting of



FIG. 122. WASTE-SHELL PILES AT OYSTER HOUSE, BALTIMORE MARYLAND

oysters from natural beds, and the planting, are the two methods which prevail in Chesapeake Bay.

Oysters are usually taken by tongs. A pair of these with very long handles is lowered with the jaws open. When the bed is reached, the jaws are closed and the tongs lifted with their load. In deeper water, dredging is common,

though by this method many oysters are destroyed. The dredge is a sort of rake which is dragged over the beds, pulling the oysters loose from the surface to which they are fastened. In order to preserve her oyster fisheries, which are so important as to engage more than a thousand vessels, the state of Maryland has passed laws regulating dredging.

Baltimore and Norfolk ship large quantities of oysters to northern and western cities. Some are sent away in the shell, some in kegs holding the oysters removed from the shell, and some in cans.

## Whale Fishing

If we are to embark upon a whaling voyage, we must prepare for a much longer trip than we have hitherto taken. We shall be gone for many months, perhaps years, before returning to the home port. In New Bedford, on the Massachusetts coast, or far across the country in San Francisco, we shall find vessels which will take us to the whaling grounds. If we go to the cold Arctic seas, we shall find the right whale, from which whalebone is obtained. If we wish quantities of sperm oil, then we must go to the warm Indian Ocean, where the sperm whale lives.

Most of the whaling from San Francisco is now done in modern steam vessels supplied with cannon which shoot the harpoon into the whale. We will accompany such a vessel on its long voyage to the region near the mouth of the Mackenzie River, in which vicinity much whalebone is obtained. If the whales are plentiful and easily caught, we shall be able to get back into warmer waters before the long Arctic

winter begins; otherwise we must remain penned in by the ice during the cold, dark, winter months.

The whale, you understand, is not a fish, and being without gills is not able to breathe under water as a fish does but is obliged to come to the surface for air. Its blowholes, or nostrils, are on the top of its head, and the first indication of its presence which comes to the sailor on the

FIG. 123. CAPTURE OF A SPERM WHALE

watch is the spouting from these holes of a tall column of water, sometimes fifteen or twenty feet high.

In the earlier days of whaling, and to some extent at the present time, when the lookout reported that a whale was in sight, boats put out from the ship and carefully approached the unsuspecting giant until near enough for the harpoon to be thrown. To it is attached a half mile or more of rope which is paid out swiftly if the whale swims away, and sometimes cut if he dives, for, as the creature often

goes down to great depths, the boat and its crew may be in danger of being carried under the water. This method of whaling is much more dangerous than the modern one of shooting the harpoon from the vessel, as the wounded whale may turn furiously upon the small boat and completely wreck it with one sweep of his large tail.

FIG. 124. SPERM WHALING OFF THE HAWAIIAN ISLANDS

The whale, when dead, is fastened to the ship's side and the work of cutting off the blubber or fat begins. Huge strips, sometimes weighing several hundred pounds, are hoisted on board. These are cut into smaller pieces and subdivided until of a size more convenient to handle. These are put into huge kettles and the oil is tried out. One whale will make from fifty to one hundred barrels of oil, according to its size.

The lobster is caught chiefly in wooden pots about four feet long, shaped like a half cylinder. Nets with an opening in the center are stretched across each end so the lobster can crawl in, attracted by the bait which is hung in the middle; but, once in, it is not intelligent enough to find its way out. Sometimes many of these pots, fastened to one line, are dropped into the ocean and are not visited for two or three days. If nearer shore, they are emptied every day or oftener. When the lobsters are taken out of the pots, they are measured. All short ones should be returned to the water, for, on account of the growing scarcity, very strict laws have been made, and persons keeping the small lobsters are fined.

If not sent to market immediately, they are put into a car — a contrivance made of plank or of an old boat — and kept in the water near the shore. If properly fed and not overcrowded they may be preserved alive in these cars for a long time.

The Fish Commission, a department of the government which will be spoken of later, is doing an important work in making possible the artificial hatching of lobsters. This work requires much care, for the young are sensitive and will not survive unless conditions are favorable. The area where the lobster is found is limited to our eastern waters, stretching northward from Chesapeake Bay. None are found on the Pacific coast. The Commission has endeavored, thus far with no great success, to introduce it into new waters. Very valuable work has been done, however, in keeping the supply more plentiful. The demand has been so great in the past few years that the price has risen in consequence, and to-day lobsters are one of the most expensive articles of

ocean food. Their growing scarcity has caused the Fish Commission to double its efforts to increase the supply. The artificial hatching of lobsters and the strict laws in regard to catching the small ones have probably prevented the industry from entirely dying out.

### Sealing

West of Alaska, far out in Bering Sea, are five small islands, lone, desolate, volcanic rocks, of which few people would ever know were it not for their numerous summer residents. In May and June thousands and thousands of seals swim into Bering Sea, and take up their residence for the next few months on these lonely Pribilof Islands.

The male seals arrive first, fat, sleek fellows weighing from four to five hundred pounds apiece. Fierce fights take place as they clamber up on the shore, each one trying to seize upon the best spot for his mate, whom he selected before migration. In a short time the females arrive and each one picks out her own lord and master. In the course of a few days the baby seals are born, soft, helpless creatures, with large, expressive dark eyes and a pitiful little call that sounds like the cry of a baby. The mothers often swim off many miles from land to search for food, and return at intervals to feed the babies, but the father seal never leaves the home. Since his arrival there in early May he has eaten nothing, nor once been out into the water, but in August he leaves the island for the deep ocean where he can find plenty of food. There he will live until the next spring, when he will migrate to his summer quarters again. The mothers and the young seals remain on the island for some months longer. The little seals play on

the shore, and gradually venture into the water, where they soon learn to swim. In November they all go south to stay until the next summer.

The seal colony includes also the young male seals who are not large and strong enough to find a place to live with the others. So thousands of these bachelor brothers live in colonies by themselves, and these are the ones which are killed for their fur.

The men engaged in this work manage during the night to get between the sleeping seals and the water. In the morning they drive the frightened, bewildered creatures, in herds of a thousand or more, farther inland. They are stunned by being struck on the head with a club, and then quickly killed with a sharp knife. No gun is used, as the shot would injure the fur. Other men skin the animals and salt the skins. These are then shipped away to be dressed, most of them going to London. In the finishing process they are changed from rough hides to soft, flexible skin such as you see in coats, hats, and muffs.

The United States government has granted to one company the right to catch seals on the Pribilof Islands. For this privilege it pays the government ten dollars for every skin taken. Years ago the seals were so much more numerous that more than one hundred thousand were killed on the islands in one season. Now less than twenty thousand are slaughtered in that time.

From what we have said thus far about the killing of seals, you can probably see no reason why they should be growing fewer in number each year, for by the method described only the bachelor seals are killed, while the mothers and fathers are allowed to come to the rocks every summer

and raise their families in peace. If the bachelor seals were the only ones killed, there would be no need of the discussions which have been held in our country and England during the past few years concerning the seal fisheries and what should be done to protect them.

But there are many sailors, Canadians and Japanese especially, who have engaged in catching seals in the open ocean, when they are migrating to or from their summer home. These sailors shoot the seals from boats which put out from the vessel. Of course, by this method it is impossible to tell whether it is a male or a female which is killed. More often it is the latter, as she swims more slowly than the male. It is nearly always the mother which is taken by vessels entering Bering Sea in the summer, for you remember that the male seal never leaves the island until he swims south to his winter home. For every mother killed in this way there is a baby seal left on the island to starve.

Since many people of Canada, which is a colony of England, are engaged in this ocean sealing, our country and England have tried to come to some agreement by means of which this unwise slaughtering may be stopped and the seal colony may be allowed to increase in numbers. If persisted in, the seals of the north will, in a few years, be almost wholly exterminated, as they have been in the southern oceans. The closing of the whole of Bering Sea to sealing vessels during the summer months, and allowing only the young males on the islands to be slaughtered, would probably remedy the evil. But if this is not done soon, the industry will become a thing of the past, as fewer and fewer seals are left each year to visit the islands.

## The Work of the Fish Commission

Many of the chief food fish were formerly much more plentiful than at the present time. In some waters, fish that in the early history of our country formed an important food for the settler have now entirely disappeared. This is due to several causes, one of the greatest of which is the carelessness and greed of some fishermen, who are so anxious to secure a good catch that not enough fish are left to replenish the stock. To overcome this difficulty and to preserve our fisheries, the governments of some of the states and of the United States have established fish commissions which are doing a valuable work.

As an example of what the United States Fish Commission is accomplishing, let us look for a moment at the industry in the Great Lakes. Herring, whitefish, and trout are the three most important fish, commercially considered, which are found in these waters, and these are the ones most likely to be exterminated. The danger comes principally from three causes: overfishing, the use of nets with too fine meshes which catch the smaller fish, and fishing during the spawning season. The yield of trout in 1893 was three and one half million pounds. In five years it decreased to less than two million pounds. The number of whitefish caught also lessened rapidly from year to year.

Trout and whitefish spawn in the early autumn. Both fish lay an immense number of eggs, a trout averaging five or six thousand and a whitefish more. Many of these eggs are destroyed, but billions develop into tiny fish. At Duluth is a fish hatchery, one of the many carried on under direction of the Fish Commission of the United States. The

work of the men in charge of the hatching begins with the collecting of eggs. Sometimes the fish are gathered at spawning time into pens, where the eggs are taken from them. Sometimes the men go out in boats to places frequented by the fish, and obtain the eggs there.

Frequently millions of these eggs are shipped to other countries to stock waters where the supply of fish is decreasing, or to introduce them to new waters. Eggs from the government hatcheries have been sent to Mexico, South America, and even to far-away Japan, and successfully hatched there.

This work requires the greatest care, for any change in the temperature, in the kind of water required, or in any one of the many conditions which contribute to the successful hatching of the eggs would cause complete failure. After the eggs are hatched, great care is taken of the young fish. They must be kept in water never too warm nor too cold, and given just the right kind of food, so that they may be as strong and vigorous as possible. When able to care for themselves and to obtain their food from the water, they are carried to the place for which they were designed, and left to finish their life in their own way.

Numbers are not very interesting, but they may serve to tell us something of the extent of the work done by the Fish Commission in the Great Lakes alone. As many as nineteen million trout and three hundred and twenty-six million whitefish were put into the water in one season. Even if only a small proportion live, the value of the work is great.

## Topics for Study

### I

1. A visit to Gloucester.
2. A trip to the banks of Newfoundland.
3. Methods of catching and preserving cod and mackerel.
4. Fishing regions of the world.
5. Uses to which different parts of fish are put.
6. Salmon fishing.
7. Oyster fishing.
8. Whaling.
9. Lobster fishing.
10. Sealing.
11. Work of the Fish Commission.

### II

1. Do the following problems concerning the catch of the whaling fleet during the year referred to in this chapter.

2. The value of whalebone is about five dollars a pound, of whale oil thirty-eight cents a gallon, and of sperm oil fifty cents a gallon. Find the average number of pounds of whalebone to each whale; the average number of gallons of whale oil obtained from each right whale; the average number of gallons of sperm oil obtained from each sperm whale. Ascertain the value of the whalebone, also of the oil, and the total value of the whaling industry for the year.

3. Make a list of articles that must be taken on a fishing cruise.

4. What information did you get in Chapter IV which relates to fishing?

5. Explain the fogs around Newfoundland.

6. Write the life story of a salmon.

7. Read Rudyard Kipling's fishing story, "Captains Courageous."

### III

Be able to spell and pronounce the following names. Locate each place and tell what is said of it in this chapter and in any previous chapter. Describe the method of fishing suggested by each topic.

| | | |
|---|---|---|
| Boston | China | North Sea |
| Gloucester | France | Merrimac River |
| Marblehead | | Columbia River |
| Astoria | Washington | Great Lakes |
| Duluth | Oregon | Chesapeake Bay |
| New Bedford | Alaska | Long Island Sound |
| San Francisco | Mexico | Hudson Bay |
| Baltimore | California | |
| Norfolk | Maryland | seining |
| | New York | trawling |
| Newfoundland | Connecticut | gill-netting |
| Nova Scotia | Maine | trapping |
| Cuba | | tonging |
| Porto Rico | Arctic Current | dredging |
| Japan | Gulf Stream | |

## General Review

1. Make a list of all the cities mentioned in this book. About how many can you tell some fact? How many can you locate?
2. Name all the countries mentioned. Locate them and tell in which industry they were spoken of.
3. In how many of the industries have you learned of help given by the United States government?
4. What articles are manufactured from so-called waste products?
5. On an outline map, trace all water routes mentioned in this book
6. Sketch routes of all the railroads.
7. What different maps have you learned to draw?

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Industrial studies.

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